Item 2.8

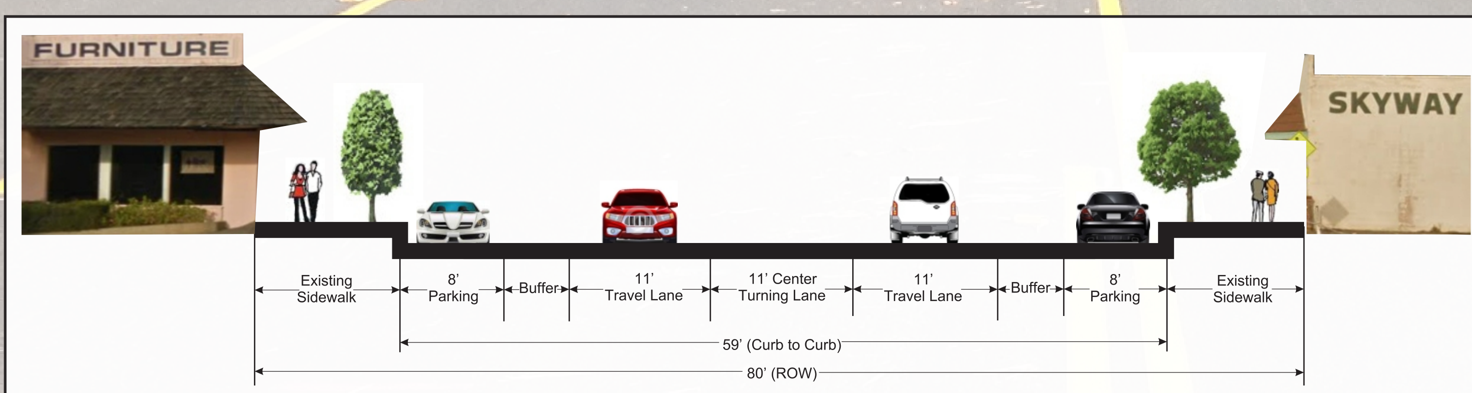
TRANSPORTATION & SAFETY STUDY

Downtown Paradise Safety Project

Town of Paradise, California

Prepared for:

December, 2013



Prepared by:

TRAFFIC WORKS LLC

2240 St. George Lane, Suite 1 • Chico • CA • 95926 • 530.897.0199

TRANSPORTATION & SAFETY STUDY

DOWNTOWN PARADISE SAFETY PROJECT

December 17, 2013

Prepared for:

Town of Paradise, CA
5555 Skyway
Paradise, CA 95969

Prepared by:

Traffic Works, LLC
2240 St. George Lane, Suite 1
Chico, CA 95926

REGISTERED PROFESSIONAL ENGINEER
LOREN EDWARD CHILSON
No. C 61425
Exp. 6.30.15
CIVIL
STATE OF CALIFORNIA

12.17.13

Table of Contents

List of Figures

List of Tables

EXECUTIVE SUMMARY

Background

Skyway is a principal arterial roadway which interconnects Chico, Paradise, Magalia and the upper ridge area of Butte County. Through development and growth, the purpose and use of Skyway within the Paradise Town limits has changed. Currently its connectivity to employment destinations for upper ridge residents has caused the Skyway downtown district between Pearson Road and Elliott Road to evolve from a quaint commercial destination to a major thoroughfare which functions as a four-lane undivided highway.

The current conditions on Skyway have prompted a complete re-evaluation of the road's configuration to determine if opportunities exist to both accommodate the traffic volume and present a viable downtown business corridor. As a result, the Town partnered with Butte County Association of Governments (BCAG) to complete the *Skyway Corridor Study, 2009*. The study thoroughly examined alternatives, sought public input, and ultimately recommended a reduction in travel lanes between Pearson Road and Elliott Road. The benefit of the lane reduction is the opportunity to enhance both pedestrian and motorist safety in addition to providing improved access to local businesses.

In October 2012, the Town of Paradise applied for and received a Highway Safety Improvement Program (HSIP) Grant to design and build a project which implements the recommendations of the *Skyway Corridor Study*. This funding source utilizes actual collision data and proposed improvement costs to formulate a benefit-cost ratio for the selection of project features. In total, the grant provides a $900,000 contribution to the estimated $1,025,000 project cost. Town Council approved the Downtown Paradise Safety Project grant agreement on April 9, 2013 and authorized staff to begin the preliminary engineering phase.

Purpose

This update aims to further evaluate the proposed alternative which reduces travel lanes on Skyway between Pearson Road and Elliott Road. Ultimately, it is critical to gain full understanding of associated impacts of the project to allow for an informed decision making process regarding the project benefits which may be achieved. Additionally, this study identifies what specific intersection configurations and signal system modifications would be necessary to support the proposed lane reduction.

Proposed Project

The HSIP grant was awarded based on three proposed countermeasures (CM) to address ongoing safety issues within the downtown area, as listed below:

CM1 – Road Diet (R15)
CM2 – Signal Coordination (S3)
CM3 – Enhanced Pedestrian Crosswalks (NS18)

Countermeasure 1 will re-configure Skyway between Pearson Road and Elliott Road from a four-lane cross-section to a three-lane cross-section, including one lane per direction and a center two-way left-

turn lane. The anticipated benefits of this modification include slower speeds, improved access to parking and commercial destinations, reduction of common collision types, and allowance for the construction of safer pedestrian facilities.

Countermeasure 2 will coordinate the signals in the downtown segment to facilitate efficient movement of traffic on Skyway during peak hours. The anticipated benefits of signal coordination include reduction in overall stops and travel delays and efficient traffic movement on the Skyway by allowing for large groups of vehicles to efficiently flow through a series of traffic signals without stopping.

Countermeasure 3 will install pedestrian crossings with enhanced safety features and curb-extensions.

Existing Conditions with Road Diet

A Level of Service (LOS) analysis was performed at critical intersections in the downtown corridor to study potential impacts of the proposed project. The analysis showed all study intersections will operate with acceptable levels of service during both the AM and the PM peak hours. Outside of peak hours, the Skyway can be expected to operate more quickly and efficiently with a better LOS condition and lower delays than during peak hours.

In addition to the LOS analysis, a micro-simulation was also performed to estimate the queue lengths at Skyway/Pearson Road and Skyway/Elliott Road. The estimated average and maximum queue lengths are generally acceptable with the exception of the northbound queues at Skyway/Pearson during the PM peak hour, which are estimated to be nearly 500 ft and 800 ft respectively. Despite the long queues during PM peak hour, the simulation showed that the queues would generally be cleared in one signal cycle due to the proposed optimized and coordinated signal timings (Countermeasure 2).

Future Conditions

Based on Butte County Association of Governments' (BCAG) travel demand model, the projected traffic volumes are expected to increase between 3% and 13% by the year 2020. Recognizing the difficulty of projecting traffic growth, a conservative 10% growth rate was used to analyze the future horizon year traffic conditions. The analysis showed that in the future, delays would increase, however all study intersections would operate at or above the Town of Paradise General Plan LOS "D" threshold, with the exception of the unsignalized intersection of Skyway/Black Olive Drive. If Skyway/Black Olive Drive remains unsignalized, motorists will experience heavier delays turning to or from Skyway. With a 10% growth in vehicle volumes, queue lengths are also expected to increase compared to 2013 conditions. However, future planned improvement projects could mitigate the effects of potential traffic growth. Projects including signalization of the Skyway/Black Olive Road intersection, intersection control improvements at Black Olive Road/Foster Road intersection, and possibly the long-term extension of Buschmann Road to Skyway, could relieve capacity pressure along Skyway between Pearson Road and Elliott Road.

Final Recommendation

Within the last 10 years an ever growing number of communities have implemented road conversions within their downtown districts to calm traffic, reclaim the pedestrian environment, revitalize businesses, and reduce the occurrence of both vehicular and pedestrian crashes that impact the lives of their family and friends. Through the recent Skyway HSIP grant award, the Town of Paradise has immediate funding available to implement the proposed roadway conversion and realize the benefits desired by so many communities, including:

- Safer, enhanced pedestrian crossings with bulb-outs for better visibility of pedestrians
- Reduced travel speeds
- A center-turn lane for safer and more efficient turning maneuvers
- Safer and more efficient on-street parking buffered from the travel lanes
- Investment and design features that support business revitalization

In order to realize these significant benefits, the Town and it's residents will need to accept a decrease in roadway capacity on Skyway between Pearson Road and Elliott Road. The roadway conversion will result in increased delay and longer vehicle queue lengths on Skyway (particularly at Elliott Road during the AM peak period and at Pearson Road during the PM peak period) and increased delay on the side-street approaches to Skyway during the peak traffic flows. The studied intersections are all shown to operate at acceptable levels of service after the proposed roadway conversion. Our detailed traffic operations analysis and simulations indicate that, although the vehicular queue lengths will notably increase during peak traffic flows, the implementation of optimized signal phasing and coordination patterns will provide reasonable management of existing traffic volumes. We recommend that the road diet is feasible, will provide the intended and important safety benefits, and that the current traffic flows are manageable with the planned traffic signal timing/coordination and lane configuration improvements.

INTRODUCTION

Skyway is one of two principal arterials serving the Town of Paradise. The westerly extent of Skyway connects the southern boundary of the City of Chico to the Town of Paradise, Magalia and upper ridge area of Butte County. The 16 miles between Magalia and Chico along Skyway have highly contrasting road configurations, terrain, and adjacent land uses. Through Paradise, Skyway enters as a four lane divided highway and becomes undivided south of Neal Road. The four-lane undivided configuration continues from Neal Road to Bille Road where the lanes are reduced to one in each direction. This configuration continues to the upper Town limits, ultimately connecting to Magalia. The Average Daily Traffic (ADT) on Skyway within the Town Limits has grown in the previous decades to roughly 25,000 between Neal Road and Pearson Road and 20,500 between Pearson Road and Elliott Road. Skyway between Wagstaff Road and the Town Limits carries an ADT of 10,000, evidence of the commuter traffic influence along this corridor. Examining potential destinations and the lack of alternate routes to Chico, it can be assumed approximately 50% of traffic through downtown Paradise is actually for daily commuting purposes with those trips originating outside the Town Limits.

The increased volumes along Skyway and its evolved use as a commuting “highway” to and from the City of Chico has created a list of changes which have negatively impacted the Town of Paradise central business district between Pearson Road and Elliott Road. In 2009, this evolution prompted the Town to work with the Butte County Association of Governments to study Skyway with the perspective of moving traffic volumes and meeting livable community objectives.

The Skyway Corridor Study was completed by W-Trans, a transportation engineering consultant. The report included extensive public input and evaluated use alternatives for Skyway within the Town Limits. The final preferred alternative for Skyway between Pearson Road and Elliott Road included one lane per direction with a center two way left turn lane.

In 2012, the California Department of Transportation issued a “call for projects” under the Highway Safety Improvement Program (HSIP). This federal-aid grant opportunity funds projects at 90% reimbursement, up to $900,000 for projects which can quantify injury reducing benefits compared to actual project costs. HSIP grant applications require submission of actual collision data which can be attributed to proposed countermeasures (CMs) with defined cost ratios.

The Town of Paradise submitted a grant application under the HSIP call for projects for the Downtown Paradise Safety Project. This application was aimed at securing funding to implement recommendations made in the Skyway Corridor Study. By proposing the implementation of a reduction in travel lanes, installation of a two-way left turn lane, signal coordination, and improved pedestrian crosswalks, the Town of Paradise was awarded the maximum grant amount of $900,000 federal aid towards the $1,025,000 total project cost.

The Town of Paradise Town Council formally authorized staff to execute the preliminary engineering funding agreement on April 9, 2013. Town staff then hired Traffic Works to perform an additional analysis of the proposed countermeasures for existing and future traffic volumes.

The purpose of this report is to provide a professional recommendation based on the current information available, information collected, potential project benefits, and most importantly, ultimate project feasibility and what specific measures would be necessary for project success.

EXISTING CONDITIONS

Problem Statement

Heavy traffic volumes coupled with a lack of turn lanes, multiple driveways, and numerous pedestrian crossings create a variety of operational and safety issues along the Skyway corridor. The heavy traffic volumes through the downtown have forced the Skyway to function as a highway rather than a "main street". Some of the field pictures showing current conditions on Skyway are shown in **Figure 1**.

Figure 1. Images Showing Skyway Functioning as a Highway

Four lane roadways often generate excessive speeds. Motorists using four-lane roadways, note that there are spare lanes in their direction and hence tend to drive faster than they should. Vehicles often change lanes to move out of slow moving lanes when the leading vehicle(s) slow down to make right or left-

turning movements. Abrupt lane change behavior and vehicles stopping in the “fast lane” can lead to serious rear-end crashes. Without a left turn lane, left turning vehicles stop in the travel lane until they find a safe gap in the opposing traffic, causing backups on Skyway.

Non-motorized travel, such as walking and biking, are important elements of the transportation system and the provision, extent, and quality of non-motorized facilities affect mode choice. High speed and high volume four-lane roadways also erode the ability for transit, walking and bicycling to succeed. Pedestrians have difficulty finding gaps across four lanes and many bicyclists find four-lane roads too narrow to ride comfortably. On roadways with two or more lanes of vehicles traveling in the same direction, if one vehicle stops for a pedestrian/bicycle and another vehicle overtakes it on either side, the pedestrian/bicycle may not be visible and can be hit (this condition is commonly referred to as dual threat). In this situation, the pedestrian may be blocked from the view of other approaching motorists by a stopped vehicle, thereby increasing a vehicle-pedestrian crash risk. Skyway has six un-controlled mid-block pedestrian crossings between Pearson Road and Elliott Road. Each of these are on a 4-lane cross-section which is potentially more dangerous for pedestrians. Mid-block locations tend to experience higher travel speeds, further contributing to pedestrian-vehicle collision risk.

Study Area Roadway Configuration

The project study area includes 2.3 miles of the Skyway corridor from Neal Road (south end) to Bille Road (north end). According to California Road System Maps, Skyway is classified as a Principal Arterial. The Skyway corridor within the study area consists of three character zones that are each different and distinct from each other.

Neal Road to Pearson Road: Skyway along this section has a five-lane cross-section with two travel lanes in each direction and a two-way left turn lane in between. The speed limit changes from 50 mph to 35 mph. The land use in this section is mostly commercial with some office buildings. There is no on-street parking.

Pearson Road to Elliott Road: This segment through the downtown is an un-divided four lane roadway with on-street parking and sidewalks on both sides of Skyway. The sidewalks vary from 5 to 8 feet wide. Six mid-block pedestrian crossings are located between Pearson Road and Elliott Road. The land use in this section is predominantly commercial. The speed limit on Skyway is 35 mph in this section.

Elliott Road to Bille Road: The cross-section of Skyway between Elliott Road and Bille Road transitions between a five-lane roadway with two-way left turn lane and a four-lane undivided roadway. The land use in this section mainly consists of commercial buildings. There is no on-street parking and the speed limit on this segment is 30 mph.

NO SCALE

LEGEND

- Project Area

(X) - Study Intersection

FIGURE 2

Transportation & Safety Study

Vicinity Map

The major study intersections included in the traffic analysis are:

- Skyway and Neal Road - Four legged signalized intersection.
- Skyway and Black Olive Drive – Four legged un-signalized (TWSC) intersection with STOP signs on Black Olive Drive and free movement on Skyway.
- Skyway and Pearson Road – Three legged signalized intersection.
- Skyway and Elliott Road – Four legged signalized intersection.
- Skyway and Oliver Road – Four legged signalized intersection.
- Skyway and Maxwell Road – Three legged signalized intersection.
- Skyway and Bille Road – Four legged signalized intersection.

The study area and the study intersections are shown in **Figure 2**.

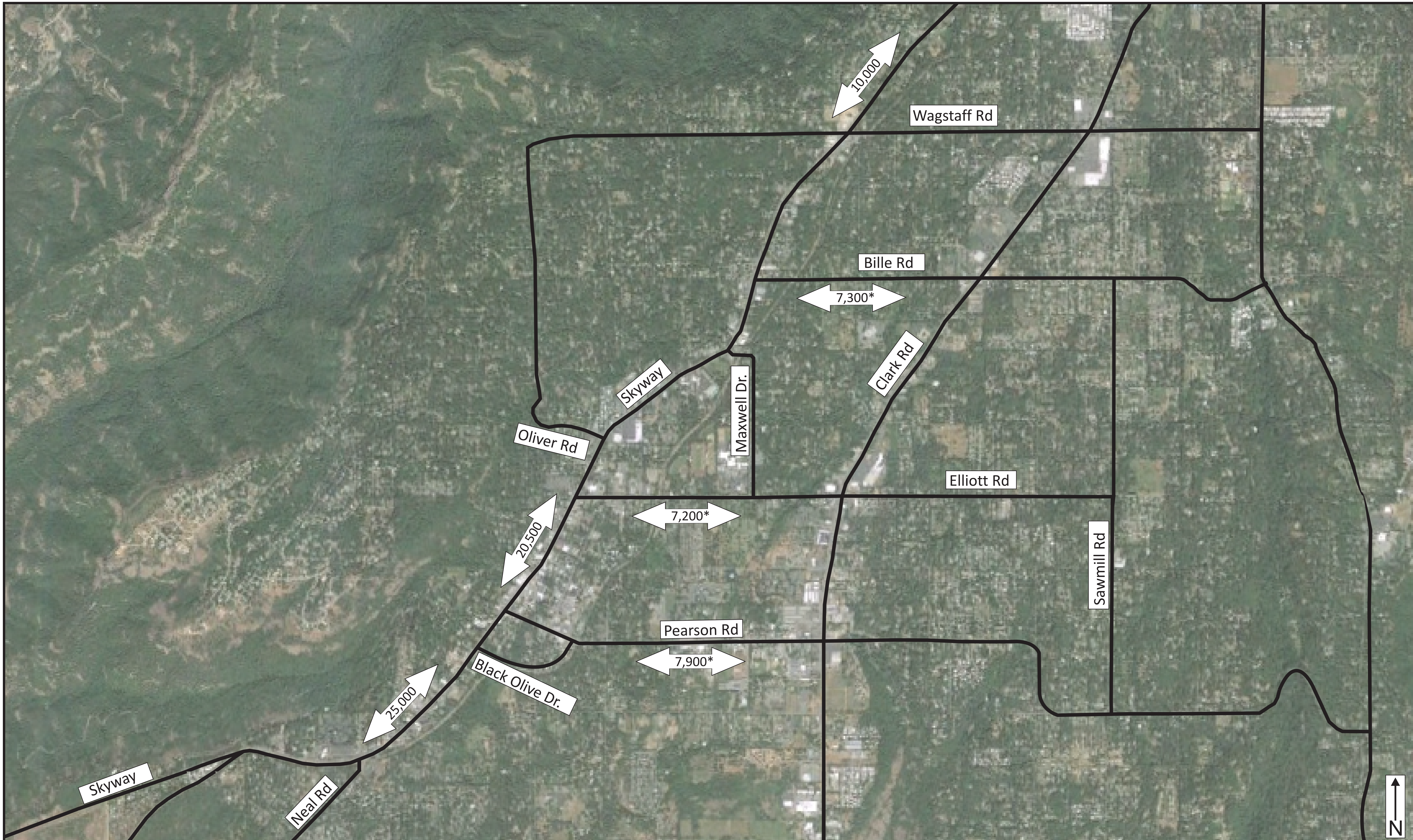
Non-motorized Facilities

The Skyway corridor and the side streets in the study area generally accommodate non-motorized travel modes. Sidewalks exist through most of the study area along the Skyway corridor. The width of sidewalks varies between 5 feet and 8 feet through the downtown area. Six uncontrolled pedestrian crosswalks across Skyway are available in the downtown area. The locations of uncontrolled crossings are shown in **Figure 3**. There are no dedicated bike lanes within the Skyway corridor.

Vehicular Volumes

The ADT on Skyway between Pearson Road and Elliott Road is approximately 20,500 vehicles per day and the ADT on Skyway south of Pearson Road is approximately 25,000 vehicles per day. Directional peaking occurs on Skyway. During the AM peak hour, the proportion of traffic traveling southbound is higher than the percentage of traffic travelling northbound. The southbound volumes on Skyway during the AM peak hour range from 900 to 1,000 vehicles per hour through downtown. The peaking occurs in the reverse direction during the PM peak hour. Southbound volumes on Skyway during the AM peak hour range from 1,000 to 1,100 vehicles per hour through downtown. The existing ADTs and turning movement volumes are shown in **Figure 4** and **Figure 5**, respectively.

Figure 3. Uncontrolled Pedestrian Crossings



TRAFFIC WORKS LLC

NO SCALE

LEGEND

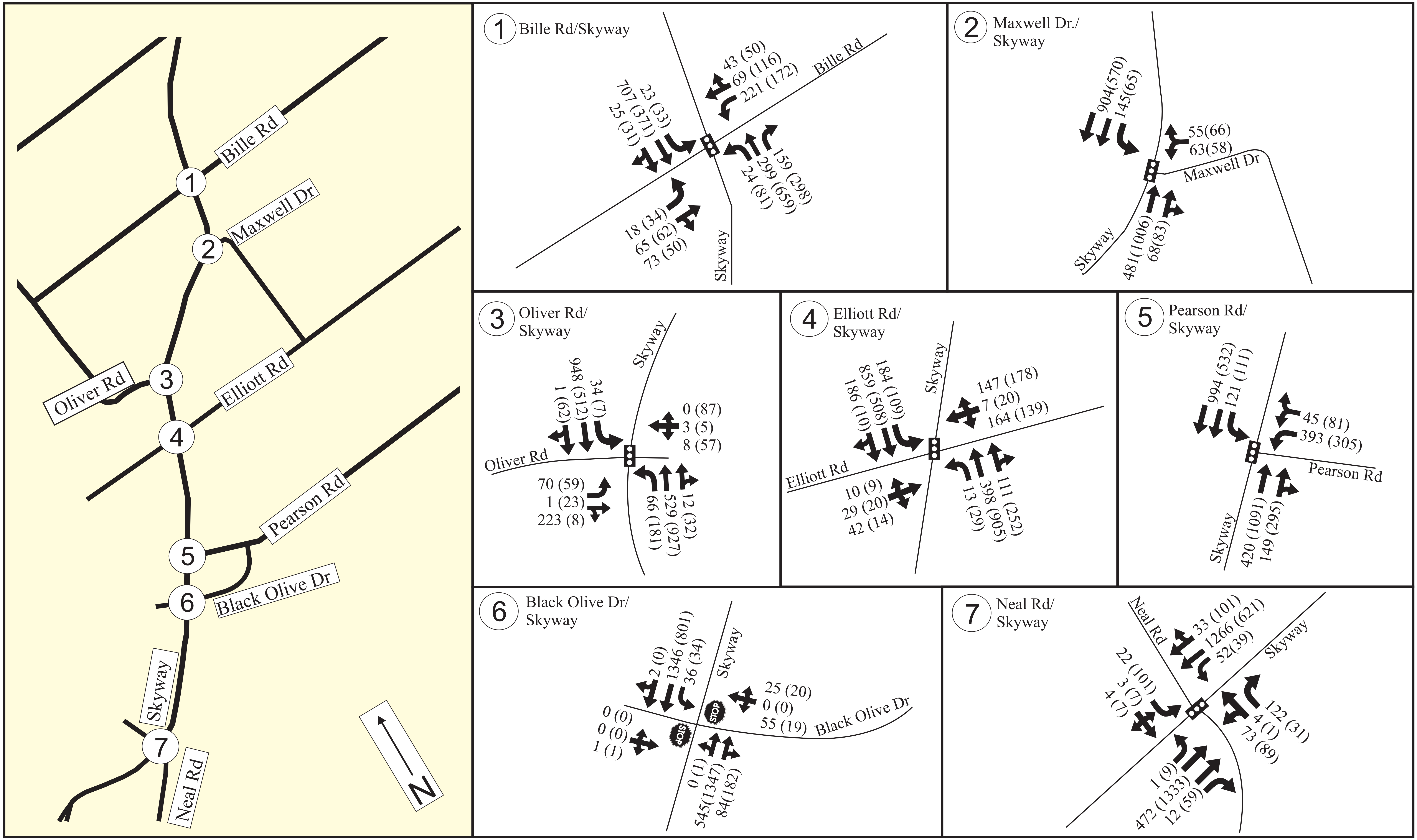
XX,XXX - ADT Volume

* - Based on Peak Hour x 10

FIGURE 4

Transportation & Safety Study

Existing Daily Traffic Volumes



TRAFFIC WORKS LLC

NO SCALE

LEGEND

xx(xx) - AM(PM) Volumes

- Study Intersections

- Stop Sign

- Traffic Signal

- Lane Configurations

FIGURE 5

Transportation & Safety Study

Existing Turning Movement Volumes

Speed Survey Data

Speed data at locations along Skyway was obtained from the speed surveys conducted by the Town of Paradise in September 2013. Speed survey data was collected for two segments – Neal Road to Pearson Road (south of downtown) and Pearson Road to Elliott Road (downtown Paradise). Speed data is summarized below by the posted speed limit, average observed speed, and the observed 85th percentile speed.

Table 1. 2013 Speed Data Summary

Segment		Posted Speed Limit (mph)	Average Observed Speed (mph)	85th %tile Observed Speed (mph)	% of vehicles above Speed Limit
From	To				
Neal Rd	Pearson Rd	35	34.9	38.1	36.40%
Pearson Rd	Elliott Rd	30	29.7	33.2	35.80%

Table 1 summarizes the speed survey data along Skyway. Generally, vehicles on Skyway are traveling at speeds slightly higher than the speed limit. The speed limit on Skyway between Neal Road and Pearson Road is 35 mph. In this segment, 37% of motorists are travelling at a speed greater than the speed limit. The observed 85th percentile speed is 38.1 mph which is higher than the speed limit. The speed limit on Skyway between Pearson Road and Elliott Road (downtown) is 30 mph. In this segment, 36% of motorists are travelling at a speed greater than the speed limit. The observed 85th percentile speed is 33.2 mph which is again higher than the speed limit.

Speeding traffic will make it more difficult and less safe for pedestrians to cross Skyway. High speeds also increase the potential for rear-end collisions and vehicles trying to turn in to/out of driveways will find fewer gaps in the opposing traffic.

Crash History and Trends

Collision data was obtained from 2002-2011 to help identify high-crash locations and to understand how the crashes occur. Skyway, as an undivided four lane highway between Pearson Road and Elliott Road, has observed the highest concentration of injury collisions in the Town of Paradise over a 10-year period (2002-2011). During this time, 90 injury collisions have been recorded to the Transportation Injury Management System (TIMS), a statewide injury collision analysis tool. A majority of the crashes were rear-end collisions accounting for 55% of overall crashes, followed by broadside crashes (24%). Summary information of the collisions trends is provided in the following **Figures 6, 7 and 8**. During this time period there were two fatalities within the study area and a third occurred in May 2013.

Figure 6. Injury Collision Severity (2002-2011)

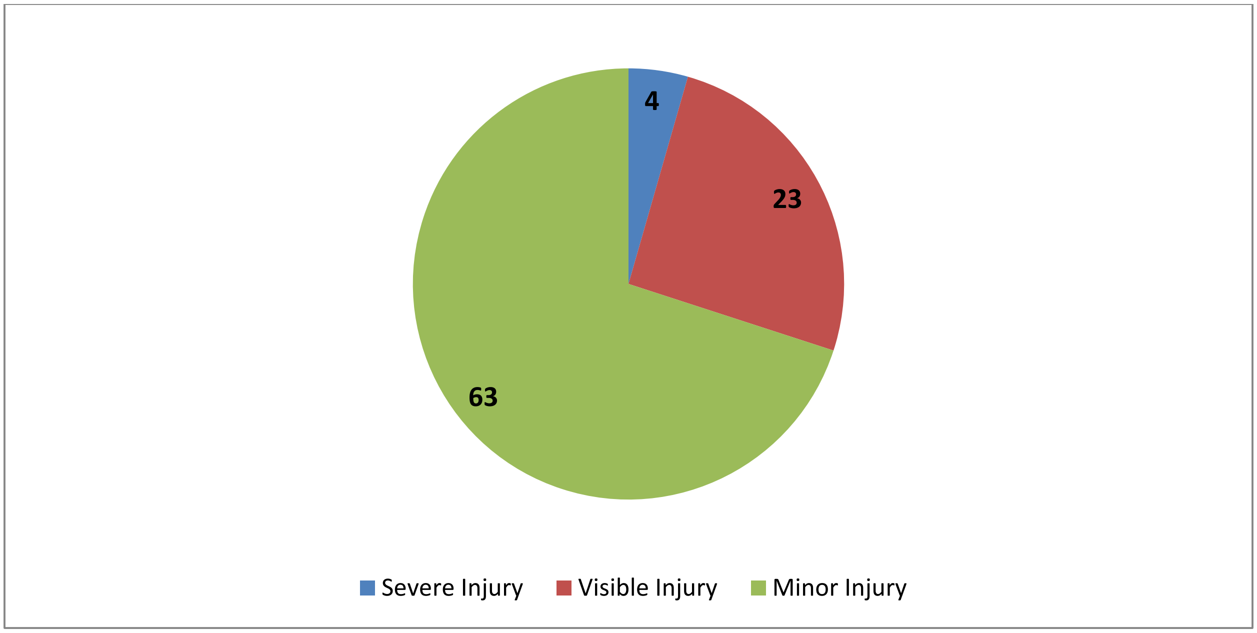


Figure 7. Collision Type (2002-2011)

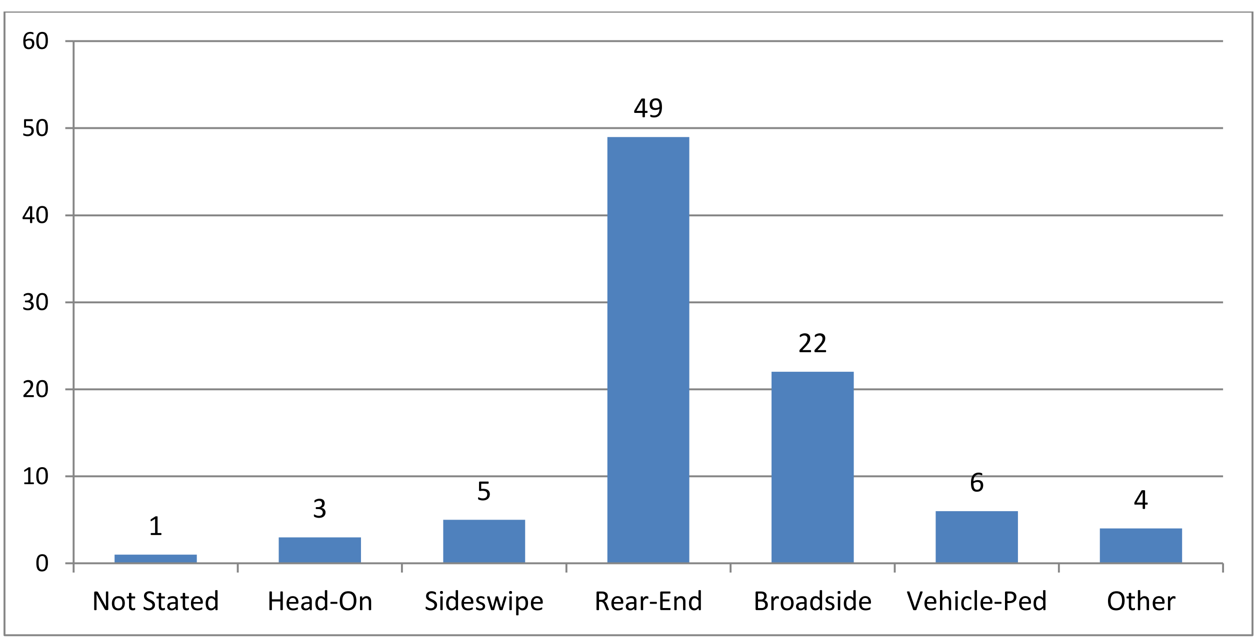


Figure 8. Motor Vehicle Collisions Involved With Other Roadway Elements/Users (2002-2011)

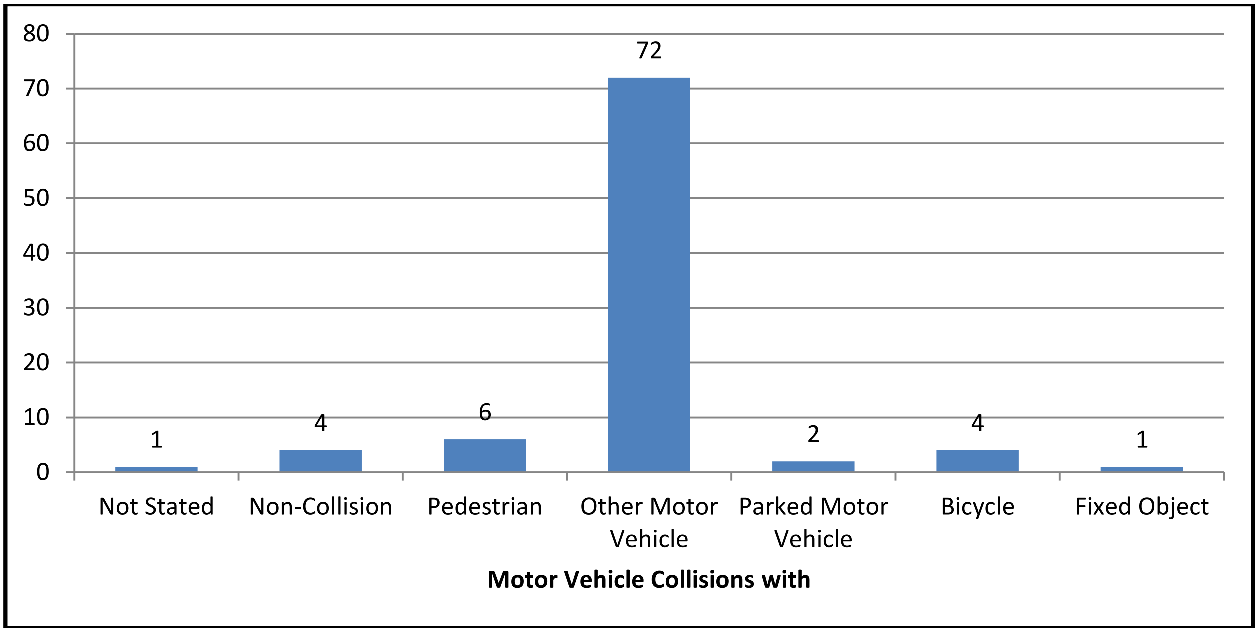


Table 2. Primary Collision Factors

Primary Collision Factor	Total	Percentage
Not Stated	4	4.40%
Unknown	2	2.20%
DUI Alcohol or Drug	7	7.80%
Unsafe Speed	43	47.80%
Wrong Side of Road	5	5.60%
Unsafe Lane Change	1	1.10%
Improper Turning	1	1.10%
Automobile Right-of-Way	16	17.80%
Pedestrian Right-of-Way	5	5.60%
Pedestrian Violation	2	2.20%
Traffic Signals and Signs	3	3.30%
Unsafe Starting or Backing	1	1.10%

Overarching trends in the collision data show a high volume of rear-end collision types. As shown in **Table 2**, 48% of the collisions, unsafe speed was reported as a primary collision factor. This is a direct indication that a two-way left turn lane and traffic calming would provide safety benefits in this segment. In addition, 10 of 93 collisions (about 11%) involved a bicyclist or pedestrian, the group most susceptible to severe injuries. Road diets can help reduce the number of collisions involving pedestrians or bicyclists by creating fewer lanes of traffic to cross (removing the dual threat) and by reducing vehicle speeds.

PROPOSED PROJECT

Countermeasures

Understanding the current conditions along Skyway, specifically in the downtown corridor, the Town of Paradise is seeking a solution which transforms Skyway between Pearson Road and Elliott Road into a safer, more pedestrian friendly, business-oriented destination. Moving forward the recommendations of the 2009 Skyway Corridor Study, the Town of Paradise secured a Highway Safety Improvement Program (HSIP) grant which provides funding for three primary countermeasures within the project area.

Countermeasure 1 – Road Diet

A road diet, or road conversion, is the process of reconfiguring the available right-of-way on a given road from two lanes in each direction (4-lane layout) to one lane in each direction with a center two-way left-turn lane (3-lane layout). Road diets can offer potential benefits to both vehicles and pedestrians. Road diets typically reduce vehicle speeds and vehicle interactions during lane changes, which potentially reduces the number and severity of vehicle-to-vehicle crashes.

The well documented benefits of implementing a road conversion include:

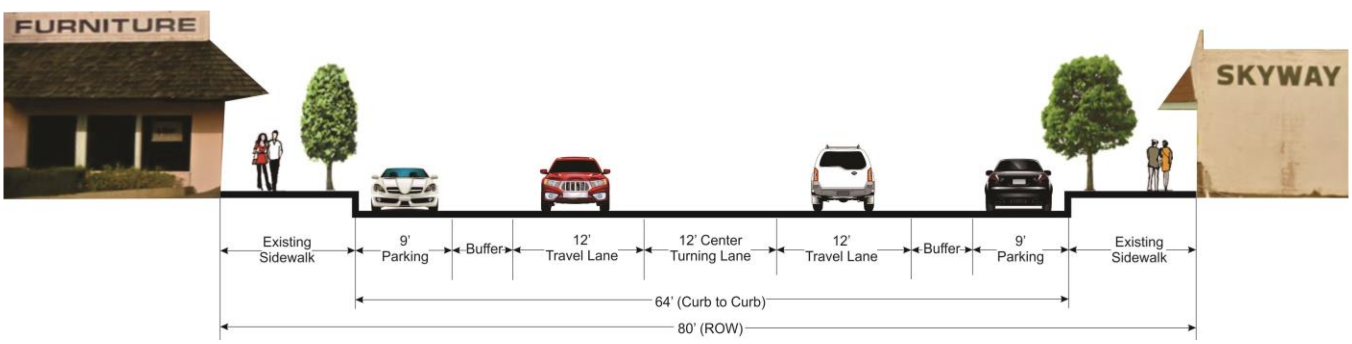
> *Collision Reductions* – A road conversion is an effective strategy to reduce collision types associated with two-lanes in each direction and the absence of left turning lanes. These collision types include head-on, left-turn, rear-end, and sideswipe same-direction collisions. The proposed road diet (CRF "R15") is anticipated to reduce certain types of crashes by 30%. A crash reduction factor (CRF) is the percentage crash reduction that might be expected after implementing a given countermeasure at a specific site. The factors have been developed through extensive research and established methodologies outlined by the Federal Highway Administration. In 2006, the Highway Safety Information System issued a study entitled "Evaluation of Lane Reduction 'Road Diet' Measures and Their Effects on Crashes and Injuries." This report on the performance of road diets in California and Washington, found crash rates to be six percent lower on streets with road diets compared to similar streets without treatments.
>
> *Access Improvements* – Providing a dedicated center two-way left-turn lane allows motorists to safely access adjacent commercial establishments or connecting roadways without stopping in the "fast lane" to make a left-turn.
>
> *Speed Reduction / Traffic Calming* – Four lane undivided highways converted using a road diet typically experience a reduction in overall travel speeds. Providing one travel lane per direction restricts opportunities for motorists to make abrupt passing movements and calms overall driver behavior. Reducing travel speeds in areas with high pedestrian concentrations is a critical element to improve overall safety and collision severities will typically decrease as a result.

Pedestrian Enhancements – Effective use of the available road width can allow for construction of pedestrian facilities which increase visibility and safety for crossing movements. This safety benefit is further discussed in Countermeasure 2.

Limitations of road conversions are based upon the volume of traffic using the corridor. According to a study conducted by the Federal Highway Administration (Publication Number: FHWA-HRT-04-082), Road Diets would work under most average daily traffic (ADT) conditions tested. Road diets have minimal effects on vehicle capacity, because left-turning vehicles are moved into a common two-way left-turn lane. However, for road diets with ADTs above approximately 20,000 vehicles, there is a greater likelihood that traffic congestion will increase to the point of diverting traffic to alternate routes.

The proposed project includes the implementation of a road diet along Skyway between Pearson Road and Elliott Road. The ADT on this section current exceeds 20,000 vehicles per day, which prompts a detailed analysis of potential consequences such as Level of Service degradation, vehicular capacity reduction, and longer queue lengths. These measurement tools and anticipated effects are discussed in detail later in this report. A typical cross-section of Skyway with a road diet in downtown area is illustrated in **Figure 9**.

Figure 9. Cross-section of Skyway with Road Diet between Pearson and Elliott



Countermeasure 2 – Improve Signal Timing (phasing and coordination)

Coordinating traffic signals within a defined corridor provides more efficient operation at the signalized intersections in addition to the road which connects them. The ultimate objective of this countermeasure is the reduction of collision types associated with isolated signal devices. Coordinating the traffic signals has been shown to reduce associated accident types by 15% (Crash Reduction Factor "S3"). In addition, signal coordination can improve corridor level of service, reduce queue lengths, and decrease travel delays.

The proposed project includes the coordination of the existing traffic signals at Skyway/Elliott Road, Skyway/Pearson Road and potentially at Skyway/Oliver Road. Coordinating these signals is a key factor in managing high traffic volumes within the road diet limits. Without signal coordination, implementation of Countermeasure 1 might not be feasible.

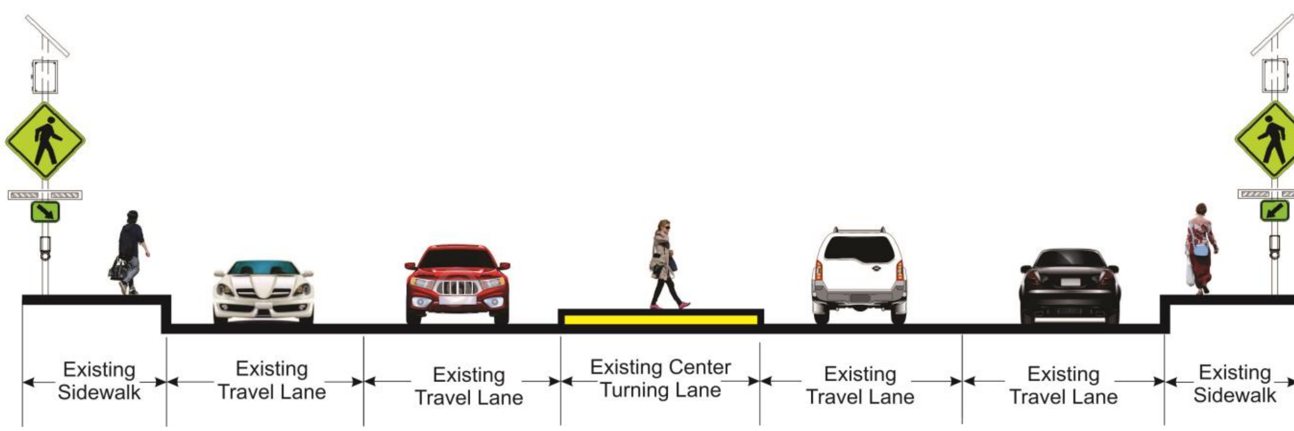
Countermeasure 3 – Install Pedestrian Crossing with Enhanced Safety Features / Curb Extensions

Providing safe pedestrian crossings within any corridor is a critical priority. This countermeasure includes the implementation of a combination of curb extensions, refuge islands, and/or pedestrian activated flashing beacons. Providing bulb-outs and pedestrian activated crossing devices is proven to improve pedestrian safety and reduce pedestrian related accidents by 35% (crash reduction factor "NS18"). Integrating pedestrian facilities within the roadway design is important to provide a safe and usable facility for all travel modes. Without proper consideration, pedestrians are discouraged from using walking as a mode of transportation or visiting commercial destinations.

The proposed project includes the installation of two types of crosswalk treatments at various locations along Skyway between Vista Way and Elliott Road.

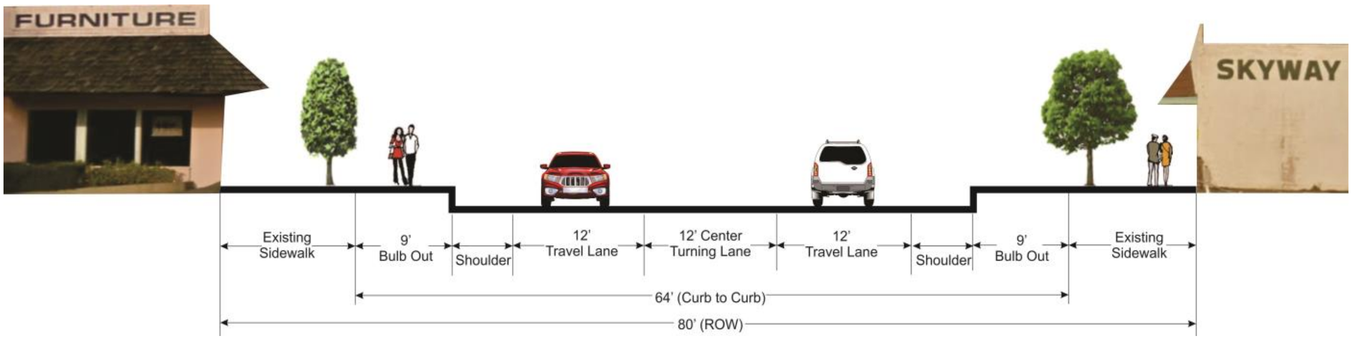
The first of these is the installation of either rectangular rapid flashing beacons (RRFB) or a pedestrian hybrid signal with a center refuge island at 5555 Skyway (near Jewell Road). This crosswalk has historically presented challenges to pedestrian safety, as it has two lanes in each direction which pedestrians must navigate when crossing. The installation of a center refuge island will allow pedestrians to clear each direction of traffic individually with an opportunity to seek a protected rest area in the middle of the roadway. In addition, a pedestrian activated system will better catch the attention of drivers and improve motorist yield rates. The cross-section of Skyway with this type of crosswalk is shown in **Figure 10**.

Figure 10. Cross-section of Skyway with Rapid Flashing Beacons and Center Refuge Island



The second crosswalk type will be implemented at 4 to 5 locations within the downtown section of Skyway, between Pearson Road and Elliott Road. These crosswalks will include the installation of both curb extensions and rapid rectangular flashing beacons. Curb extensions decrease the physical distance which pedestrians are expected to cross. In addition, they significantly improve visibility between motorists and pedestrians. Finally, curb extensions facilitate increased parallel parking in the downtown corridor, as clearance/buffer zones between crosswalks and permitted parking are no longer necessary. The benefit of this measure with flashing beacons is again, the clear communication of pedestrians to motorists of their intent to cross the street. The cross-section of Skyway with bulb-outs, or curb extensions, is shown in **Figure 11**.

Figure 11. Cross-section of Skyway with Curb Extensions



Outside the proposed countermeasures used for grant award, the project will also include an asphalt overlay between Pearson Road and Elliott Road, intersection configuration adjustments, ADA curb return/ramp upgrades, spot sidewalk repairs, and crosswalk street lighting as funding allows.

Nexus Summary

A road diet on the downtown section of Skyway would remedy most of the wide range of issues identified in the problem statement. It should be noted that all proposed changes to Skyway would occur within the existing right-of-way. Based on the “Skyway Corridor Study” report produced by W-Trans in February 2009 and discussions with Town of Paradise staff, it was agreed that a three-lane section through downtown Paradise would serve all of the project goals and that this configuration should be studied to identify the benefits and any potential impacts. The portion of Skyway between Pearson Road and Elliott Road would be reconfigured as a three-lane section with one travel lane in each direction and a two-way left turn lane. The traffic signals at Pearson Road, Elliott Road and Oliver Road would be retimed to provide optimized and coordinated traffic movement through the downtown area. The potential traffic impacts and benefits of implementing the road diet are discussed in detail in the following sections.

METHODOLOGY

Data Collection

Appropriate and accurate traffic data collection is crucial for making well informed decisions and for providing quantitative evidence. In order to analyze the existing operating conditions and to estimate the potential traffic impacts of road diet, Traffic Works collected and gathered data from various sources. The different types of data that were collected and gathered for this project are as follows:

- Weekday 24-hour traffic volume counts
- Turning movement counts
- Speed Survey Data
- Crash Data
- BCAG Travel Demand Model projections

- Historic counts along Skyway
- Miscellaneous data from field observations such as roadway geometrics, lane widths, lengths of turn lanes, crosswalk lengths etc.,

Level of Service

Level of service (LOS) is an estimate of the quality and performance of the transportation system operations. The industry standard for evaluating traffic conditions is based on the Transportation Research Board's (TRB) methodology outlined in the Highway Capacity Manual (HCM), Special Report 209 (TRB 2000). Using this methodology, traffic conditions are assessed with respect to the average intersection delay (seconds/vehicle). The letter "A" is used to describe the least amount of congestion and best operations, and the letter "F" indicates the highest amount of congestion and worst operations. The 2000 HCM level of service criteria for signalized and un-signalized intersections are shown in **Table 3**.

Table 3. Level of Service Criteria for Signalized and Un-signalized Intersections

LOS Rating	Brief Description	Average Delay for Signalized Intersections (seconds/vehicle)	Average Delay for TWSC Intersections (seconds/vehicle)
A	Free flow conditions.	0-10	0-10
B	Stable conditions with some affect from other vehicles.	>10-20	>10-15
C	Stable conditions with significant affect from other vehicles.	>20-35	>15-25
D	High density traffic conditions still with stable flow.	>35-55	>25-35
E	At or near capacity flows.	>55-80	>35-50
F	Over capacity conditions.	> 80	> 50

Source: HCM 2000, modified from Exhibits 16-2 and 17-2; TWSC: two-way stop control.

LOS ratings for TWSC and three-legged stop-control intersections are based on the worst movement average delay; LOS is not defined for the overall intersection.

Level of Service Policy

The Town of Paradise strives to maintain Level of Service "D" or better for all intersections (signalized and un-signalized). LOS "D" was therefore used as the criteria and threshold for determining significant impacts.

Queue Lengths

Queue length is defined as the total length of vehicles stopped in a lane behind the stop line and is reported in feet. The evaluation of traffic signals focuses on the estimation of delays and queue lengths that result from various signal control strategies at individual intersections, as well as on progression, or the sequence of arrivals at consecutive intersections. Traffic queues are the principle performance measure used in determining and evaluating of adequacy of turn lane lengths. Unlike level of service standards, the "acceptability" of queue lengths is not defined by industry standards. The performance measure is mainly relative to the context of the project and community. For this study, the queue lengths

were estimated to report the impacts of a road diet and to determine the turn lane lengths. SimTraffic simulation software was used to estimate the maximum and average queue lengths.

The maximum queue is the maximum back of queue observed for the entire analysis interval (1 hour for this study). This is a simple maximum, without any averaging. The maximum queue is calculated independently for each lane. The queue reported is the maximum queue for an individual lane, not the sum of all lane queues. SimTraffic records the maximum back of queue observed for every two minute period. The average queue is the average of all the two minute maximum queues. Vehicles can stop when queued and when waiting for a lane change. The SimTraffic software attempts to determine whether the stopping is due to queuing or lane changes and reports the queue lengths appropriately.

PRE-PROJECT ANALYSIS

Non-motorized Facilities

As detailed in prior sections, there are a variety of safety concerns, particularly regarding pedestrian crossings, on Skyway within the downtown segment. All things considered, the most significant issue is the “dual threat” condition associated with crossing multiple lanes in each direction of travel. This condition could only be corrected with a road diet and would not be addressed if the proposed project was not implemented.

Without the project, no improvement would be realized for the bicycle travel mode.

Traffic Volumes (current and future)

Turning movement counts were collected at all the study intersections on a regular weekday, from 7:00 AM to 9:00 AM and from 4:00 PM to 6:00 PM. This data was used to identify the heaviest morning and evening traffic conditions. At each of the study intersections, the one-hour period with the heaviest traffic volumes (referred to as the peak hour) was calculated from the morning and evening data. Pedestrian crossing volumes and heavy vehicle data were also collected. Peak hour counts show that the Skyway experiences directional peaking with the vast majority of traffic travelling southbound during the morning peak and northbound during evening peak. In addition to turning movement counts, 24-hour volume counts were also collected at various locations along the corridor. The existing weekday average daily traffic (ADT) on Skyway in the Paradise downtown area is 20,500 vehicles/day. The existing ADT and peak hour traffic volumes are shown in **Figure 4** and **Figure 5** respectively.

Traffic volumes in the study area could increase in the future depending on population growth and development. According to the traffic count data provided by BCAG, the Annual Average Daily traffic (AADT) values have been declining in the study area consistently since the year 2000. Historic counts also show that the peak hour traffic on Skyway north of Elliott Road has been going down since 2006. However, the BCAG travel demand forecasting model also shows that for the study area, the traffic volumes along Skyway corridor are expected to increase approximately by 3% to 13% between 2010 and 2020. The historic and projected traffic volumes along the Skyway corridor obtained from BCAG model are presented in **Table 4**.

Table 4. Historic and Projected Volumes from BCAG

Location	Year	AADT		AM Peak		PM Peak	
Skyway north of Elliott	2020*	21230	I	1560	S	1640	D
	2009/10	20558	D	1558	D	1689	D
	2006	22255	D	1937	S	1774	I
	2003	24236	I	1956		1551	
	2000	23572		NA		NA	
Skyway south of Pearson	2020*	28350	I	2170	I	2690	I
	2009/10	24905		1901		2173	

* Obtained from BCAG demand model traffic projections

I – Increase compared to previous historic count

D – Decrease compared to previous historic count

S – No change compared to previous historic count

The data from BCAG clearly shows that the traffic volumes north of Elliott Road are either decreasing in the future or remaining constant. The 2020 AM peak volumes are forecasted to remain the same as 2010 volumes and the 2020 PM peak volumes are forecasted to decrease slightly. However, the travel demand model also shows that the traffic volumes increase on Skyway south of Pearson Road. Through discussion with Town of Paradise staff, a conservative growth rate of 10% was used to estimate the future AM and PM peak hour volumes. A 10% growth in traffic would reasonably account for any future growth and development that would occur in the vicinity of Town of Paradise. The directional distribution of traffic volumes along Skyway was assumed to remain consistent with the existing conditions. The percentage of heavy vehicles was also assumed to be constant.

Traffic Operations Analysis

The intersections were analyzed using the HCM modules for signalized and un-signalized intersections in Trafficware's software program, Synchro 8.0 (Build 804). Level of service calculations were performed using the existing condition intersection configurations and traffic volumes collected. The Level of Service and delay results are presented in **Table 5** and the calculation sheets are provided in **Appendix A**, attached.

As shown in **Table 5**, all the existing study intersections currently operate at acceptable levels of service (LOS "D" or better) during both the AM and PM peak hours.

Without a road diet, the future traffic growth would have minimal impact on Skyway from strictly a traffic operations perspective. The delays and congestion on Skyway are would increase slightly with increased traffic volumes. The increased traffic volume would make it increasing harder for drivers to make left-turn movements in to/out of driveways to find a safe gap in the opposing traffic. Pedestrians would also find it increasing more difficult find safe gaps in traffic at mid-block crossings.

Table 5. 2013 Existing AM and PM Peak Hour LOS Summary

Intersection	Control		AM Peak	PM Peak
Skyway and Neal Rd	Signalized	**LOS**	B	B
		Delay (sec/veh)	14.3	15.8
Skyway and Black Olive Dr	TWSC[1]	**LOS**	C	D
		Delay (sec/veh)	16.9	33.5
Skyway and Pearson Rd	Signalized	**LOS**	B	B
		Delay (sec/veh)	12.3	17.2
Skyway and Elliott Rd	Signalized	**LOS**	C	C
		Delay (sec/veh)	20.1	21.3
Skyway and Oliver Rd	Signalized	**LOS**	B	B
		Delay (sec/veh)	11.3	11.6
Skyway and Maxwell Rd	Signalized	**LOS**	A	A
		Delay (sec/veh)	8.7	8.5
Skyway and Bille Rd	Signalized	**LOS**	C	C
		Delay (sec/veh)	24.2	27.7

1 At TWSC intersections, LOS is based on average delay experienced by the critical movement at the intersection, typically a left-turn from stop-controlled street.

PROPOSED PROJECT ANALYSIS

Non-motorized Facilities

The proposed project features, by design, would improve pedestrian safety by 1) removing the “dual threat” at all unsignalized crosswalks in the downtown segment (Pearson to Elliott), 2) making pedestrians more visible and prominent in the corridor by installing curb extensions and pedestrian activated crossing devices, and 3) by reducing vehicular speeds and creating a pedestrian environment.

Bicycle travel would also be improved between Pearson Road and Elliott Road through the additional space created adjacent to the on-street parking. Today, cyclists must take a travel lane, and force traffic to pass them, which is difficult particularly in the uphill (northbound) direction. In the 3-lane cross-section, the proposed buffer area between the travel lane and parking area would provide a space for cyclists to ride without feeling pressured by vehicles following closely behind them.

Traffic Operations Analysis

A Level of Service analysis was performed at all the study intersections assuming a three-lane configuration between Pearson Road and Elliott Road. The existing traffic volumes were used for this analysis (in other words, no traffic diversion is assumed). We did, however, optimize and coordinate the traffic signals between Pearson Road and Oliver Road. Signal Coordination refers to the timing of the signals so that a platoon of cars traveling on a street arrives at a succession of green lights and proceeds through multiple intersections without stopping. Coordinated systems are controlled from a master controller and are set up so lights "cascade" in sequence and vehicles can proceed through a continuous series of green lights. Two-way streets are often arranged to correspond with rush hours to favor the

heavier volume direction. A well-coordinated signal system can enhance traffic flow, reduce delay and minimize pollution. Other benefits of signal coordination include reduced collisions, reduced unnecessary stopping and starting of traffic, improved journey time, and reduced driver frustration or road rage.

The signal timings within the downtown were coordinated to allow efficient traffic progression in the southbound direction during AM peak hour and in the northbound direction during PM peak hour. The Level of Service and delay results for this scenario are presented in **Table 6** and the detailed output sheets are provided in **Appendix A**. As shown in the results table, even with the road diet, all the study intersections operate at acceptable level of service conditions during both the AM and PM peak hours. The LOS rating remains the same, with the road diet, at all the study intersections except for the intersection of Skyway and Pearson Road. The LOS at Skyway and Pearson Road worsens from B to C but still operates well within acceptable ranges. The intersections of Skyway/Pearson and Skyway/Elliott experience minor increase in delay due to the road diet.

In addition to coordinated signal timings, other minor improvements that can be incorporated to improve the efficiency of traffic movements are:

- Removing the east-west crosswalk on the south leg at the Skyway/Pearson Road intersection. This crosswalk, when used, ties up the intersection because no vehicle movements are permitted. Pedestrians crossing Skyway at this location can use the crosswalk on the north leg.
- Changing the outside northbound lane at Skyway/Pearson Road to a right only lane with a free-right or an overlap phase. Since the lane reduction occurs immediately north of Pearson Road, the outside lane can be converted into an exclusive right-turn lane. The proposed configuration at this intersection is shown in **Figure 12**.
- Changing the westbound right from Elliott Road to Skyway to a free-right movement. The proposed configuration at this intersection is also shown in **Figure 12**.

As the traffic volumes on Skyway are over 20,000 vehicles per day, Traffic-Works performed a detailed micro-simulation analysis in addition to the LOS analysis. SimTraffic software was used to estimate queue lengths at the critical intersections of Skyway/Pearson and Skyway/Elliott. The simulation was run for 60 minutes with a 15 minute seeding time. Seeding is completed in order to fill the network with vehicles, so that there will be vehicles in the network when simulation begins. The seeding time is usually set to be at least the amount of time (in minutes) required by a vehicle to travel from one end of the corridor to the other end. An average of five different 60-minute simulation runs was used to report queue lengths on Skyway. Averaging multiple simulation runs accounts for the daily variation in traffic.

Table 7 summarizes the expected average and maximum queue lengths on Skyway at the two critical intersections in downtown Paradise.

Table 6. 2013 LOS Comparison (With and Without Road Diet)

Intersection	Control		AM Peak		PM Peak	
			Existing	W/ Road Diet	Existing	W/ Road Diet
Skyway and Neal Rd	Signalized	**LOS**	B	B	B	B
		Delay	14.3	13.8	15.8	15.3
Skyway and Black Olive Dr	TWSC[1]	**LOS**	C	C	D	D
		Delay	16.9	20.4	33.5	33.6
Skyway and Pearson Rd	Signalized	**LOS**	B	B	**B**	**C**
		Delay	12.3	16	17.2	28.6
Skyway and Elliott Rd	Signalized	**LOS**	C	C	C	C
		Delay	20.1	21.5	21.3	26.6
Skyway and Oliver Rd	Signalized	**LOS**	B	B	B	B
		Delay	11.3	12.9	11.6	12.7
Skyway and Maxwell Rd	Signalized	**LOS**	A	A	A	A
		Delay	8.7	9.3	8.5	8.5
Skyway and Bille Rd	Signalized	**LOS**	C	C	C	C
		Delay	24.2	29.4	27.7	24.6

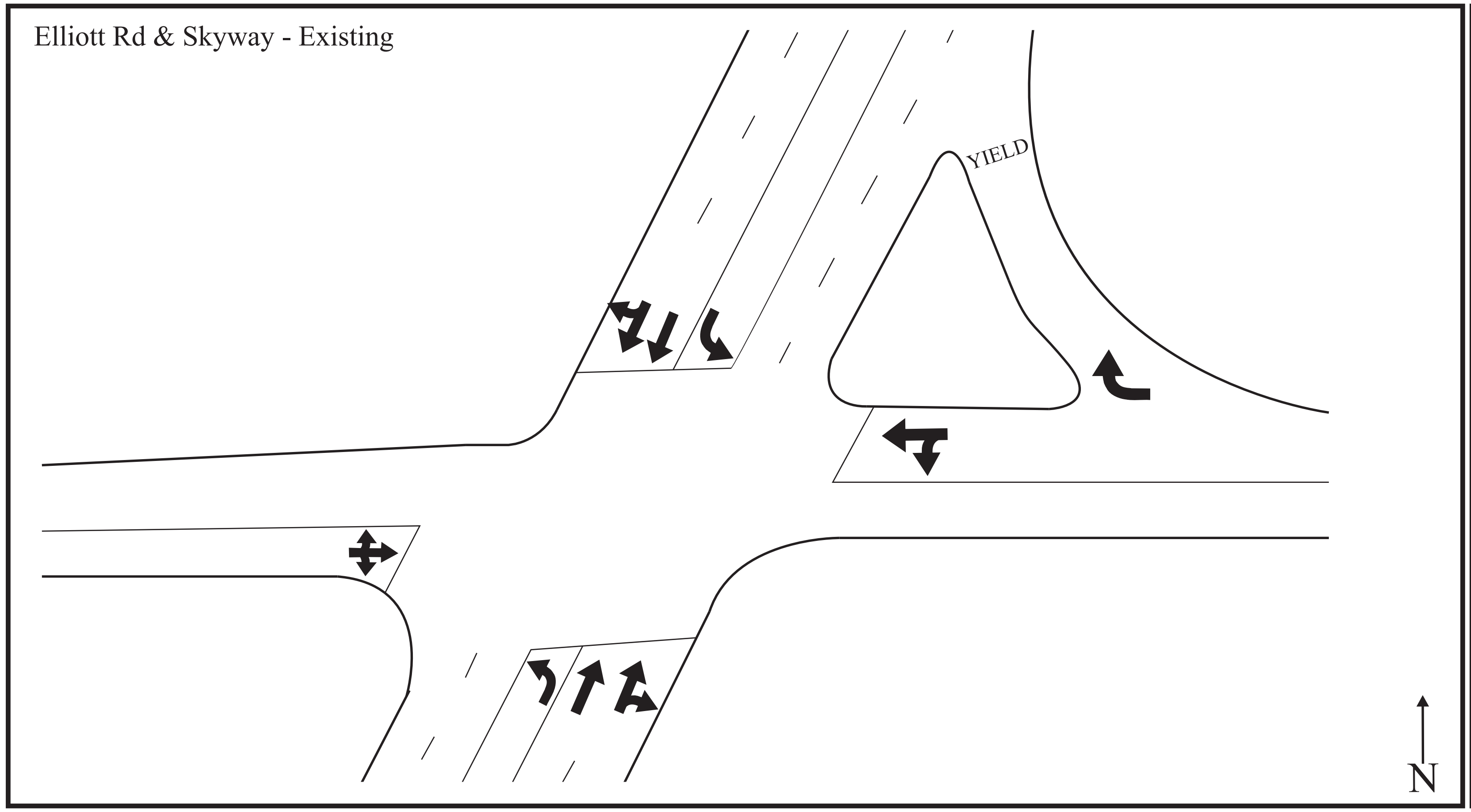
1 At TWSC intersections, LOS is based on average delay experienced by the critical movement at the intersection, typically a left-turn from stop-controlled street.

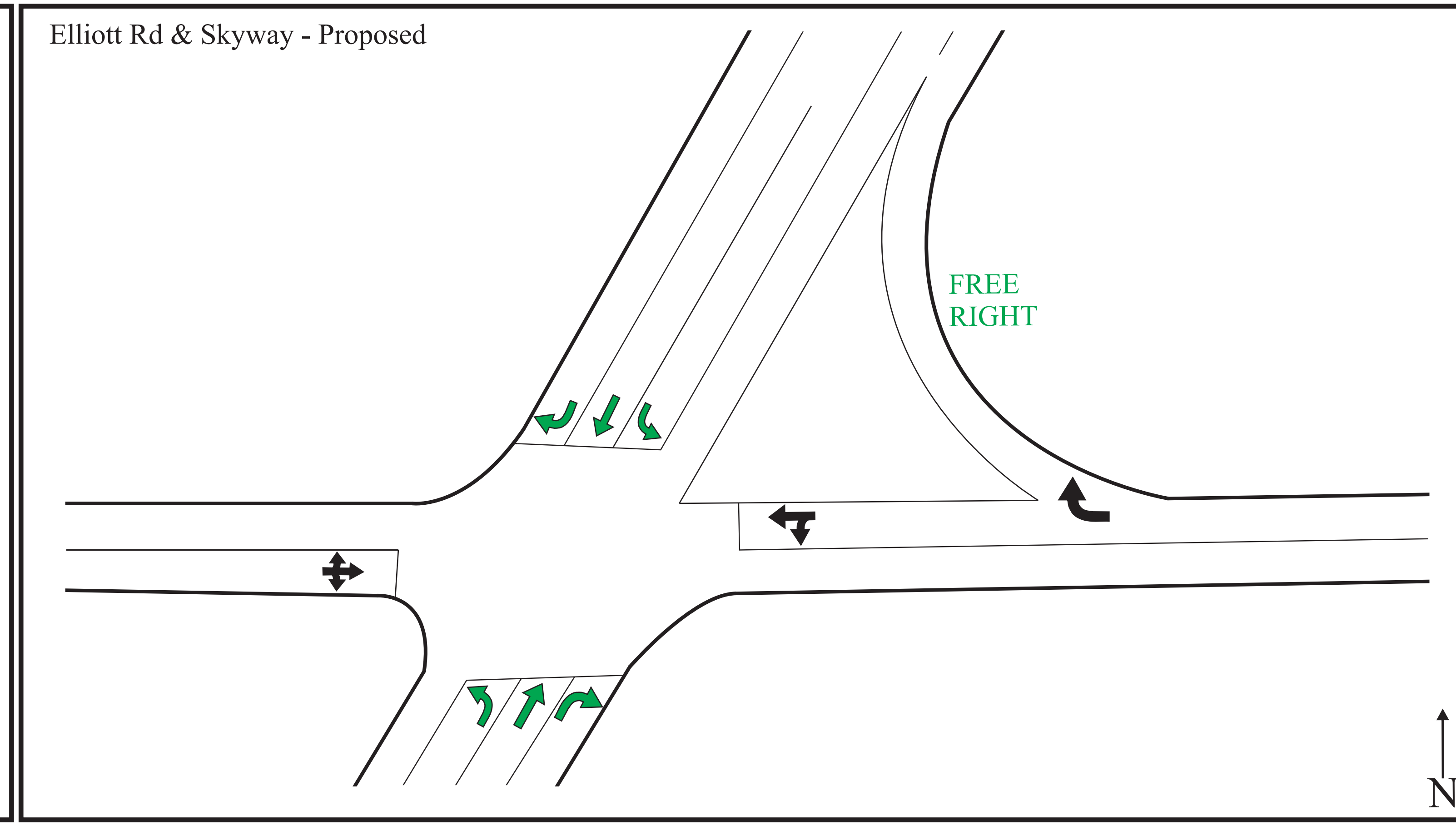
Delay is measured in seconds/vehicle.

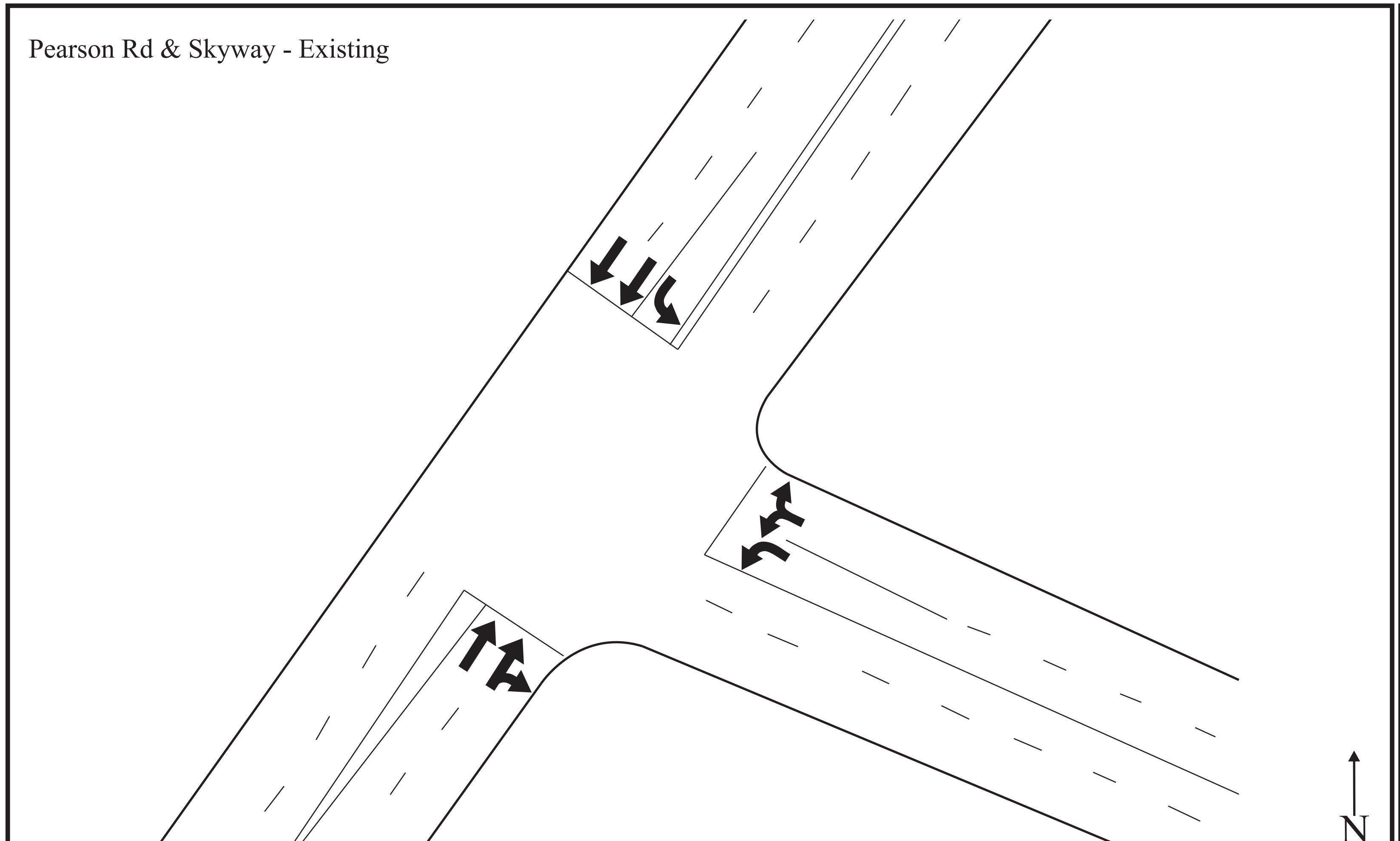
Skyway and Pearson Road is the only intersection where the LOS grade changes (from LOS B to LOS C) due to a road diet.

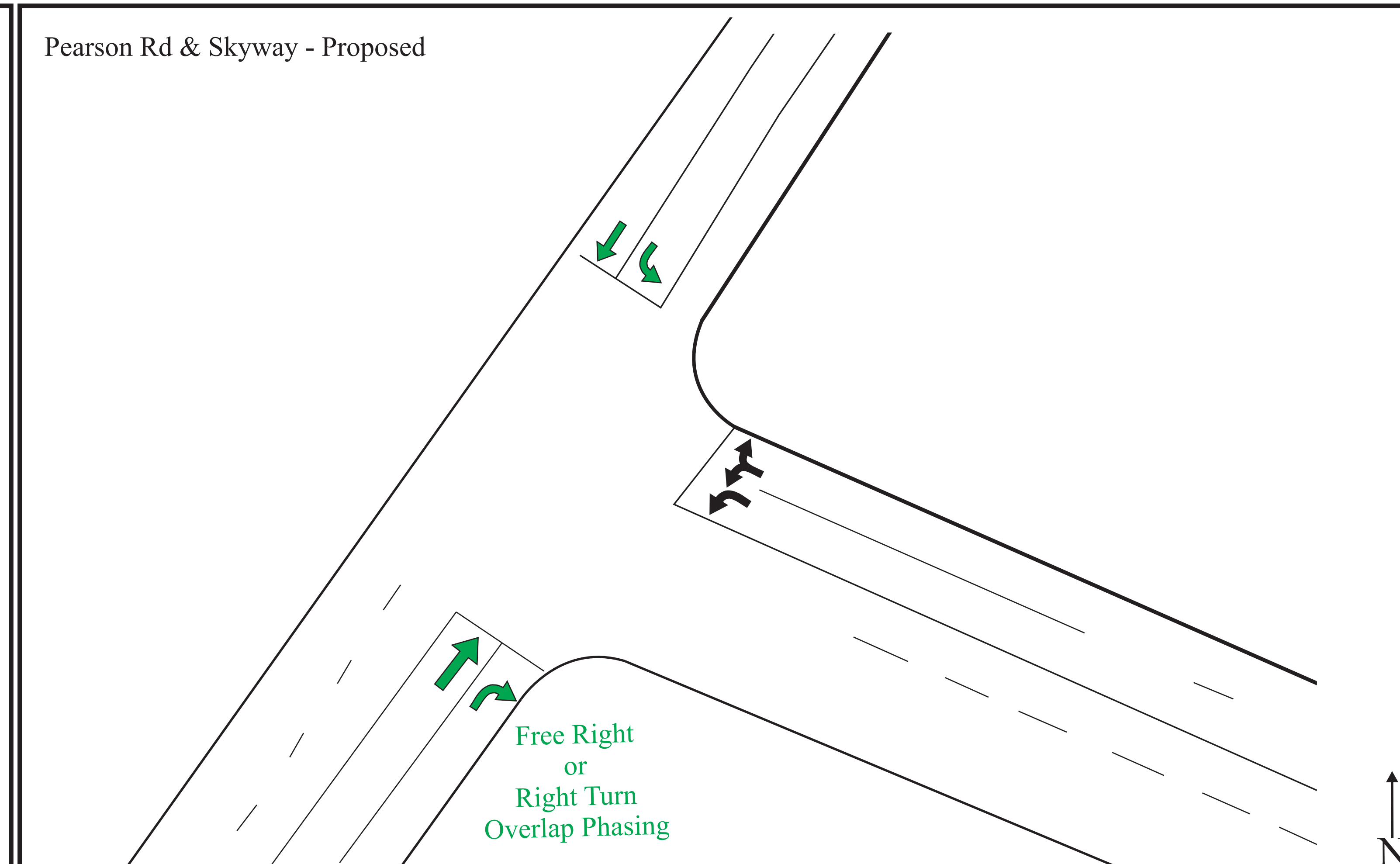
Table 7. Queue Lengths on Skyway for Existing 2013 with Road Diet

Intersection		AM Peak W/ Road Diet		PM Peak W/ Road Diet	
		NBT	SBT	NBT	SBT
Skyway and Pearson Rd	**Max Queue (ft)**	257	381	**792**	254
	Avg Queue (ft)	127	158	**460**	105
Skyway and Elliott Rd	**Max Queue (ft)**	148	325	274	269
	Avg Queue (ft)	46	108	123	97









TRAFFIC WORKS LLC

NO SCALE

LEGEND

- Proposed Lane Configuration
- Existing Lane Configuration

FIGURE 12

Transportation & Safety Study

Existing & Proposed Intersection Configurations

The results show that Skyway will experience long queues if the road diet is implemented. During the AM peak, the maximum queue occurs in the southbound direction, which is the heavy traffic movement during morning time period. The pattern reverses in the evening peak with maximum queues occurring in the northbound direction. The maximum queues during the AM peak are in the range of 300 ft to 400 ft. The maximum queue during the PM peak is nearly 800 ft which occurs on northbound Skyway at Skyway/Pearson. This queue almost spills back to the intersection of Skyway/Black Olive. However, it should be noted that the maximum queues shown in **Table 5** do not last for the entire peak hour but only for the peak 15 minute period or less (a few cycles). Realistically, through most of the peak hour, the queue lengths will be in the range of the average queues reported. All the average queue lengths are within normal ranges with the exception of the northbound queue at Skyway/Pearson during the PM peak hour. Despite the long queues during PM peak hour, the simulation showed that the queues would be cleared every cycle due to the optimized and coordinated signal timings.

The queue lengths could be further reduced by increasing the cycle length and thereby increasing the green time given to the heavy movements. Although the queue lengths could be shortened with longer cycle lengths, it should be noted that increasing the cycle length can also increase the overall intersection delay. In this scenario, since all the intersections are operating better than the threshold of LOS D, the cycle lengths could likely be increased without going over the LOS threshold and without worsening the overall intersection operation.

It is also important to provide sufficient storage for turn lanes and side streets when implementing coordinated signal timings, especially since the majority of green time is given to the coordinated movement (southbound in the AM and northbound in the PM). Spilling of turn lane queues into the through movements can cause unnecessary congestion and can often throw off signal coordination. SimTraffic simulations were also reviewed to estimate the turning movement queues and determine the turn pocket lengths at the intersections of Skyway/Pearson and Skyway/Elliott. **Table 8** shows the recommended turn pocket lengths.

Table 8. Recommended Turn Pocket Lengths

Intersection	Turn Pocket	AM Queue (ft)	PM Queue (ft)	Recommended Pocket Length (ft)[1]
Skyway/Elliott	Northbound Right	63	162	200
	Northbound Left	55	96	150
	Southbound Right	35	8	100
Skyway/Pearson	Southbound Left	288	214	300

1 The pocket lengths recommended in the above table are higher than existing queue lengths due to future traffic increase considerations.

As discussed in previous sections, traffic volumes in the overall study area could potentially grow by 10% by the year 2020. The evaluation of future conditions showed that delay at all the study intersections increases noticeably, but all the intersections with the exception of Skyway and Black Olive Drive (which is side street STOP controlled), operate at acceptable level of service conditions. With the increased delay, the queue lengths would also increase in the downtown area.

Some of the Skyway traffic originating from/destined to the north-east portion Paradise (and to some extent the upper ridge area) may move to other roadways over time due to the road diet. According to FHWA research, for road diets with ADTs above approximately 20,000 vehicles, there is a likelihood of traffic diverting to alternative routes due to increased traffic congestion. Changing travel patterns could further reduce the queue lengths and improve level of service conditions on Skyway through the downtown area. However, it should be noted that these changes in travel patterns and driver behaviors would occur over time (not immediately) as the drivers experience heavier delays and longer queues. In addition to the change in travel patterns, a variety of future planned improvement projects would accommodate the traffic growth and improve traffic operations on Skyway.

The primary intent of this project is to improve safety along Skyway in downtown Paradise. A number of other long-term improvements would provide improved operations in the overall study area and could be selected for construction later in the design phase or as separate projects. Planned improvements that could reasonably be assumed to be constructed in the future, that could alleviate the congestion in downtown include:

- signalization of the Skyway/Black Olive intersection,
- intersection control changes at Black Olive/Foster intersection and
- construction of alternative routes such as a potential Buschmann Road extension west to Skyway.

CONCLUSIONS

Within the last 10 years an ever growing number of communities have implemented road conversions within their downtown districts to calm traffic, reclaim the pedestrian environment, revitalize businesses, and reduce the occurrence of both vehicular and pedestrian crashes that impact the lives of their family and friends. Implementing a road diet on Skyway by reconfiguring it from a four-lane cross-section to a three-lane cross-section with a center turn lane will achieve the project goals including:

- Safer, enhanced pedestrian crossings with bulb-outs for better visibility of pedestrians
- Reduced travel speeds
- A center-turn lane for safer and more efficient turning maneuvers
- Safer and more efficient on-street parking buffered from the travel lanes
- Investment and design features that support business revitalization

In order to realize these significant benefits, the Town and it’s residents will need to accept a decrease in roadway capacity on Skyway between Pearson Road and Elliott Road. The roadway conversion will result

in increased delay and longer vehicle queue lengths on Skyway and increased delay on the side-street approaches to Skyway during the peak traffic flows.

The Level of Service analysis shows that the study intersections will continue to operate at acceptable Levels of Service and meet the LOS "D" or better threshold after implementation of a road diet. The micro-simulation model indicated that the worst queues would occur during the PM peak hour in the northbound direction at the Skyway/Pearson Road intersection. All the other queues are within generally accepted ranges. The queue lengths can be mitigated, for the most part, by adjusting the signal timings to clear queues on Skyway. This can be achieved by increasing the cycle lengths and providing more green time to the heavy movement on Skyway.

We recommend that the road diet is feasible, will provide the intended and important safety benefits, and that the current traffic flows are manageable with the planned traffic signal timing/coordination and lane configuration improvements.

APPENDIX A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	22	3	4	73	4	122	1	472	12	52	1266	33
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.95	0.95			1.00	1.00	1.00	0.95	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00			1.00	0.99	1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.95			1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	0.98			0.95	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1715	1678			1779	1563	1805	3406	1487	1770	3526	
Flt Permitted	0.95	0.98			0.95	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1715	1678			1779	1563	1805	3406	1487	1770	3526	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	25	3	5	83	5	139	1	536	14	59	1439	38
RTOR Reduction (vph)	0	5	0	0	0	120	0	0	7	0	1	0
Lane Group Flow (vph)	17	11	0	0	88	19	1	536	7	59	1476	0
Confl. Peds. (#/hr)						2			3			
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	0%	6%	6%	2%	2%	2%
Turn Type	Split	NA		Split	NA	Perm	Prot	NA	Perm	Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						8			2			
Actuated Green, G (s)	2.4	2.4			8.4	8.4	0.7	30.1	30.1	4.4	33.8	
Effective Green, g (s)	2.4	2.4			8.4	8.4	0.7	30.1	30.1	4.4	33.8	
Actuated g/C Ratio	0.04	0.04			0.14	0.14	0.01	0.49	0.49	0.07	0.55	
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	67	65			243	214	20	1672	730	127	1944	
v/s Ratio Prot	c0.01	0.01			c0.05		0.00	0.16		c0.03	c0.42	
v/s Ratio Perm						0.01			0.00			
v/c Ratio	0.25	0.17			0.36	0.09	0.05	0.32	0.01	0.46	0.76	
Uniform Delay, d1	28.6	28.5			24.0	23.1	30.0	9.4	8.0	27.3	10.6	
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.0	1.3			0.9	0.2	1.0	0.5	0.0	2.7	2.8	
Delay (s)	30.6	29.8			24.9	23.3	31.0	9.9	8.0	30.0	13.5	
Level of Service	C	C			C	C	C	A	A	C	B	
Approach Delay (s)		30.2			23.9			9.9			14.1	
Approach LOS		C			C			A			B	

Intersection Summary			
HCM 2000 Control Delay	14.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	61.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	61.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	1	55	0	25	0	545	84	36	1346	2
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	0	1	61	0	28	0	606	93	40	1496	2
Pedestrians		1			1						2	
Lane Width (ft)		12.0			12.0						12.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (ft)											902	
pX, platoon unblocked	0.84	0.84	0.84	0.84	0.84		0.84					
vC, conflicting volume	1910	2278	750	1482	2232	352	1499			700		
vC1, stage 1 conf vol	1578	1578		653	653							
vC2, stage 2 conf vol	333	700		829	1579							
vCu, unblocked vol	1700	2138	315	1189	2084	352	1209			700		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	82	100	96	100			96		
cM capacity (veh/h)	133	167	575	330	171	648	480			899		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	1	89	303	396	40	997	501
Volume Left	0	61	0	0	40	0	0
Volume Right	1	28	0	93	0	0	2
cSH	575	390	480	1700	899	1700	1700
Volume to Capacity	0.00	0.23	0.00	0.23	0.04	0.59	0.29
Queue Length 95th (ft)	0	22	0	0	3	0	0
Control Delay (s)	11.3	16.9	0.0	0.0	9.2	0.0	0.0
Lane LOS	B	C			A		
Approach Delay (s)	11.3	16.9	0.0		0.2		
Approach LOS	B	C					

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	55.3%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	393	45	420	149	121	994
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0		4.0	4.0
Lane Util. Factor	0.97		0.95		1.00	0.95
Frpb, ped/bikes	1.00		0.99		1.00	1.00
Flpb, ped/bikes	1.00		1.00		1.00	1.00
Frt	0.98		0.96		1.00	1.00
Flt Protected	0.96		1.00		0.95	1.00
Satd. Flow (prot)	3365		3314		1787	3574
Flt Permitted	0.96		1.00		0.95	1.00
Satd. Flow (perm)	3365		3314		1787	3574
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	437	50	467	166	134	1104
RTOR Reduction (vph)	16	0	44	0	0	0
Lane Group Flow (vph)	471	0	589	0	134	1104
Confl. Peds. (#/hr)	3	1		3		
Heavy Vehicles (%)	3%	3%	4%	4%	1%	1%
Turn Type	NA		NA		Prot	NA
Protected Phases	8		2		1	6
Permitted Phases						
Actuated Green, G (s)	12.8		25.1		6.0	35.1
Effective Green, g (s)	12.8		25.1		6.0	35.1
Actuated g/C Ratio	0.23		0.45		0.11	0.63
Clearance Time (s)	4.0		4.0		4.0	4.0
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	770		1488		191	2244
v/s Ratio Prot	c0.14		0.18		c0.07	c0.31
v/s Ratio Perm						
v/c Ratio	0.61		0.40		0.70	0.49
Uniform Delay, d1	19.3		10.3		24.1	5.6
Progression Factor	1.00		1.00		1.00	1.00
Incremental Delay, d2	1.4		0.8		11.1	0.8
Delay (s)	20.8		11.1		35.1	6.4
Level of Service	C		B		D	A
Approach Delay (s)	20.8		11.1			9.5
Approach LOS	C		B			A

Intersection Summary			
HCM 2000 Control Delay	12.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	55.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	50.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	29	42	164	7	147	13	398	111	184	859	186
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes		0.99			0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.93			0.94		1.00	0.97		1.00	0.97	
Flt Protected		0.99			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1745			1692		1770	3407		1770	3445	
Flt Permitted		0.96			0.82		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1681			1416		1770	3407		1770	3445	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	11	31	45	174	7	156	14	423	118	196	914	198
RTOR Reduction (vph)	0	33	0	0	40	0	0	24	0	0	16	0
Lane Group Flow (vph)	0	54	0	0	297	0	14	517	0	196	1096	0
Confl. Peds. (#/hr)			1			1			1			
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Perm	NA		Perm	NA		Prot	NA		Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)		20.5			20.5		0.7	31.5		13.0	43.8	
Effective Green, g (s)		20.5			20.5		0.7	31.5		13.0	43.8	
Actuated g/C Ratio		0.27			0.27		0.01	0.41		0.17	0.57	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		447			376		16	1393		298	1959	
v/s Ratio Prot							0.01	0.15		c0.11	c0.32	
v/s Ratio Perm		0.03			c0.21							
v/c Ratio		0.12			0.79		0.88	0.37		0.66	0.56	
Uniform Delay, d1		21.4			26.3		38.1	15.9		29.9	10.5	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.1			10.8		161.3	0.8		5.2	1.2	
Delay (s)		21.5			37.1		199.4	16.6		35.1	11.7	
Level of Service		C			D		F	B		D	B	
Approach Delay (s)		21.5			37.1			21.2			15.2	
Approach LOS		C			D			C			B	

Intersection Summary			
HCM 2000 Control Delay	20.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	77.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	1	223	8	3	0	66	529	12	34	948	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.85			1.00		1.00	1.00		1.00	1.00	
Flt Protected	0.95	1.00			0.96		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1787	1600			1813		1770	3526		1770	3539	
Flt Permitted	0.75	1.00			0.70		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1410	1600			1308		1770	3526		1770	3539	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	75	1	240	9	3	0	71	569	13	37	1019	1
RTOR Reduction (vph)	0	166	0	0	0	0	0	1	0	0	0	0
Lane Group Flow (vph)	75	75	0	0	12	0	71	581	0	37	1020	0
Confl. Peds. (#/hr)									1			
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Turn Type	Perm	NA		Perm	NA		Prot	NA		Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)	8.7	8.7			8.7		4.6	34.3		2.2	31.9	
Effective Green, g (s)	8.7	8.7			8.7		4.6	34.3		2.2	31.9	
Actuated g/C Ratio	0.15	0.15			0.15		0.08	0.60		0.04	0.56	
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	214	243			198		142	2114		68	1973	
v/s Ratio Prot		0.05					c0.04	0.16		0.02	c0.29	
v/s Ratio Perm	c0.05				0.01							
v/c Ratio	0.35	0.31			0.06		0.50	0.27		0.54	0.52	
Uniform Delay, d1	21.7	21.6			20.8		25.2	5.5		27.0	7.9	
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.0	0.7			0.1		2.8	0.3		8.6	1.0	
Delay (s)	22.7	22.3			20.9		28.0	5.8		35.6	8.8	
Level of Service	C	C			C		C	A		D	A	
Approach Delay (s)		22.4			20.9			8.2			9.8	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	11.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	57.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	53.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	63	55	481	68	145	904
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0		4.0	4.0
Lane Util. Factor	1.00		0.95		1.00	0.95
Frt	0.94		0.98		1.00	1.00
Flt Protected	0.97		1.00		0.95	1.00
Satd. Flow (prot)	1718		3474		1770	3539
Flt Permitted	0.97		1.00		0.95	1.00
Satd. Flow (perm)	1718		3474		1770	3539
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	72	62	547	77	165	1027
RTOR Reduction (vph)	54	0	12	0	0	0
Lane Group Flow (vph)	80	0	612	0	165	1027
Heavy Vehicles (%)	1%	1%	2%	2%	2%	2%
Turn Type	NA		NA		Prot	NA
Protected Phases	8		2		1	6
Permitted Phases						
Actuated Green, G (s)	6.4		24.8		6.1	34.9
Effective Green, g (s)	6.4		24.8		6.1	34.9
Actuated g/C Ratio	0.13		0.50		0.12	0.71
Clearance Time (s)	4.0		4.0		4.0	4.0
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	223		1747		219	2505
v/s Ratio Prot	c0.05		0.18		c0.09	c0.29
v/s Ratio Perm						
v/c Ratio	0.36		0.35		0.75	0.41
Uniform Delay, d1	19.6		7.4		20.9	3.0
Progression Factor	1.00		1.00		1.00	1.00
Incremental Delay, d2	1.0		0.6		13.6	0.5
Delay (s)	20.6		7.9		34.5	3.5
Level of Service	C		A		C	A
Approach Delay (s)	20.6		7.9			7.8
Approach LOS	C		A			A

Intersection Summary			
HCM 2000 Control Delay	8.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	49.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	40.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	18	65	73	221	69	43	24	299	159	23	707	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	0.95	
Frt	1.00	0.92		1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1787	1732		1787	1773		1770	1863	1583	1770	3521	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1787	1732		1787	1773		1770	1863	1583	1770	3521	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	19	70	78	238	74	46	26	322	171	25	760	27
RTOR Reduction (vph)	0	58	0	0	29	0	0	0	108	0	3	0
Lane Group Flow (vph)	19	90	0	238	91	0	26	322	63	25	784	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA		Prot	NA		Prot	NA	Perm	Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			
Actuated Green, G (s)	0.7	11.7		12.8	23.8		1.4	24.3	24.3	1.4	24.3	
Effective Green, g (s)	0.7	11.7		12.8	23.8		1.4	24.3	24.3	1.4	24.3	
Actuated g/C Ratio	0.01	0.18		0.19	0.36		0.02	0.37	0.37	0.02	0.37	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	18	306		345	637		37	683	581	37	1292	
v/s Ratio Prot	0.01	c0.05		c0.13	0.05		c0.01	0.17		0.01	c0.22	
v/s Ratio Perm									0.04			
v/c Ratio	1.06	0.30		0.69	0.14		0.70	0.47	0.11	0.68	0.61	
Uniform Delay, d1	32.8	23.7		24.9	14.3		32.2	16.0	13.8	32.2	17.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	230.8	0.5		5.7	0.1		46.2	2.3	0.4	39.3	2.1	
Delay (s)	263.6	24.2		30.5	14.4		78.4	18.4	14.2	71.5	19.2	
Level of Service	F	C		C	B		E	B	B	E	B	
Approach Delay (s)		51.4			25.1			20.0			20.8	
Approach LOS		D			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	24.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	66.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	50.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	101	7	7	89	1	31	9	1333	59	39	621	101
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.95	0.95			1.00	1.00	1.00	0.95	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00			1.00	0.99	1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.98			1.00	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	0.96			0.95	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1715	1708			1793	1579	1787	3574	1565	1770	3465	
Flt Permitted	0.95	0.96			0.95	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1715	1708			1793	1579	1787	3574	1565	1770	3465	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	106	7	7	94	1	33	9	1403	62	41	654	106
RTOR Reduction (vph)	0	5	0	0	0	29	0	0	30	0	8	0
Lane Group Flow (vph)	60	55	0	0	95	4	9	1403	32	41	752	0
Confl. Peds. (#/hr)						1			1			
Heavy Vehicles (%)	0%	0%	0%	1%	1%	1%	1%	1%	1%	2%	2%	2%
Turn Type	Split	NA		Split	NA	Perm	Prot	NA	Perm	Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						8			2			
Actuated Green, G (s)	6.2	6.2			7.1	7.1	0.7	32.9	32.9	2.2	34.4	
Effective Green, g (s)	6.2	6.2			7.1	7.1	0.7	32.9	32.9	2.2	34.4	
Actuated g/C Ratio	0.10	0.10			0.11	0.11	0.01	0.51	0.51	0.03	0.53	
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	165	164			197	174	19	1825	799	60	1850	
v/s Ratio Prot	c0.03	0.03			c0.05		0.01	c0.39		c0.02	0.22	
v/s Ratio Perm						0.00			0.02			
v/c Ratio	0.36	0.33			0.48	0.02	0.47	0.77	0.04	0.68	0.41	
Uniform Delay, d1	27.3	27.2			26.9	25.6	31.7	12.7	7.9	30.8	8.9	
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.4	1.2			1.9	0.0	17.5	3.2	0.1	27.6	0.7	
Delay (s)	28.6	28.4			28.8	25.6	49.1	15.9	8.0	58.3	9.6	
Level of Service	C	C			C	C	D	B	A	E	A	
Approach Delay (s)		28.5			28.0			15.7			12.1	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM 2000 Control Delay	15.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	64.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	55.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	1	19	0	20	1	1347	182	34	801	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	1	21	0	22	1	1464	198	37	871	0
Pedestrians					1						2	
Lane Width (ft)					12.0						12.0	
Walking Speed (ft/s)					4.0						4.0	
Percent Blockage					0						0	
Right turn flare (veh)												
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (ft)											902	
pX, platoon unblocked	1.00	1.00	1.00	1.00	1.00		1.00					
vC, conflicting volume	1703	2610	435	2077	2511	834	871			1663		
vC1, stage 1 conf vol	945	945		1566	1566							
vC2, stage 2 conf vol	758	1665		510	945							
vCu, unblocked vol	1698	2608	427	2073	2509	834	864			1663		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	82	100	93	100			90		
cM capacity (veh/h)	199	108	580	113	148	315	779			387		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	1	42	733	930	37	580	290
Volume Left	0	21	1	0	37	0	0
Volume Right	1	22	0	198	0	0	0
cSH	580	168	779	1700	387	1700	1700
Volume to Capacity	0.00	0.25	0.00	0.55	0.10	0.34	0.17
Queue Length 95th (ft)	0	24	0	0	8	0	0
Control Delay (s)	11.2	33.5	0.0	0.0	15.3	0.0	0.0
Lane LOS	B	D	A		C		
Approach Delay (s)	11.2	33.5	0.0		0.6		
Approach LOS	B	D					

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	59.6%	ICU Level of Service	B
Analysis Period (min)	15		

TRAFFIC WORKS LLC

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	305	81	1091	295	111	532
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0		4.0	4.0
Lane Util. Factor	0.97		0.95		1.00	0.95
Frpb, ped/bikes	1.00		1.00		1.00	1.00
Flpb, ped/bikes	1.00		1.00		1.00	1.00
Frt	0.97		0.97		1.00	1.00
Flt Protected	0.96		1.00		0.95	1.00
Satd. Flow (prot)	3352		3443		1787	3574
Flt Permitted	0.96		1.00		0.95	1.00
Satd. Flow (perm)	3352		3443		1787	3574
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	328	87	1173	317	119	572
RTOR Reduction (vph)	45	0	29	0	0	0
Lane Group Flow (vph)	370	0	1461	0	119	572
Confl. Peds. (#/hr)	2	1		3		
Heavy Vehicles (%)	2%	2%	1%	1%	1%	1%
Turn Type	NA		NA		Prot	NA
Protected Phases	8		2		1	6
Permitted Phases						
Actuated Green, G (s)	11.0		26.1		5.0	35.1
Effective Green, g (s)	11.0		26.1		5.0	35.1
Actuated g/C Ratio	0.20		0.48		0.09	0.65
Clearance Time (s)	4.0		4.0		4.0	4.0
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	681		1661		165	2318
v/s Ratio Prot	c0.11		c0.42		c0.07	0.16
v/s Ratio Perm						
v/c Ratio	0.54		0.88		0.72	0.25
Uniform Delay, d1	19.3		12.6		23.9	4.0
Progression Factor	1.00		1.00		1.00	1.00
Incremental Delay, d2	0.9		7.0		14.4	0.3
Delay (s)	20.2		19.6		38.3	4.2
Level of Service	C		B		D	A
Approach Delay (s)	20.2		19.6			10.1
Approach LOS	C		B			B

Intersection Summary			
HCM 2000 Control Delay	17.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	54.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
4: Skyway Rd & Elliott Rd

12/9/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	9	20	14	139	20	178	29	905	252	109	508	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.95			0.93		1.00	0.97		1.00	1.00	
Flt Protected		0.99			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1788			1717		1805	3476		1787	3563	
Flt Permitted		0.93			0.84		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1689			1479		1805	3476		1787	3563	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	10	22	16	156	22	200	33	1017	283	122	571	11
RTOR Reduction (vph)	0	12	0	0	75	0	0	30	0	0	2	0
Lane Group Flow (vph)	0	36	0	0	303	0	33	1270	0	122	580	0
Confl. Peds. (#/hr)			1			1			1			1
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	1%
Turn Type	Perm	NA		Perm	NA		Prot	NA		Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)		16.0			16.0		1.4	24.8		5.1	28.5	
Effective Green, g (s)		16.0			16.0		1.4	24.8		5.1	28.5	
Actuated g/C Ratio		0.28			0.28		0.02	0.43		0.09	0.49	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		466			408		43	1488		157	1753	
v/s Ratio Prot							0.02	c0.37		c0.07	c0.16	
v/s Ratio Perm		0.02			c0.20							
v/c Ratio		0.08			0.74		0.77	0.85		0.78	0.33	
Uniform Delay, d1		15.5			19.1		28.1	14.9		25.8	8.9	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.1			7.1		56.1	6.4		21.1	0.5	
Delay (s)		15.6			26.2		84.2	21.3		46.9	9.4	
Level of Service		B			C		F	C		D	A	
Approach Delay (s)		15.6			26.2			22.9			15.9	
Approach LOS		B			C			C			B	

Intersection Summary			
HCM 2000 Control Delay	21.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	57.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	75.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

TRAFFIC WORKS LLC

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	59	23	8	57	5	87	181	927	32	7	512	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96			0.92		1.00	0.99		1.00	0.98	
Flt Protected	0.95	1.00			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1787	1804			1717		1787	3556		1787	3508	
Flt Permitted	0.60	1.00			0.86		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1133	1804			1506		1787	3556		1787	3508	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	62	24	8	60	5	92	191	976	34	7	539	65
RTOR Reduction (vph)	0	7	0	0	79	0	0	1	0	0	7	0
Lane Group Flow (vph)	62	25	0	0	78	0	191	1009	0	7	597	0
Confl. Peds. (#/hr)			4									3
Heavy Vehicles (%)	1%	1%	1%	0%	0%	0%	1%	1%	1%	1%	1%	1%
Turn Type	Perm	NA		Perm	NA		Prot	NA		Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)	8.3	8.3			8.3		9.0	38.6		0.8	30.4	
Effective Green, g (s)	8.3	8.3			8.3		9.0	38.6		0.8	30.4	
Actuated g/C Ratio	0.14	0.14			0.14		0.15	0.65		0.01	0.51	
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	157	250			209		269	2299		23	1786	
v/s Ratio Prot		0.01					c0.11	c0.28		0.00	0.17	
v/s Ratio Perm	c0.05				0.05							
v/c Ratio	0.39	0.10			0.37		0.71	0.44		0.30	0.33	
Uniform Delay, d1	23.4	22.4			23.3		24.1	5.2		29.2	8.7	
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.6	0.2			1.1		8.5	0.6		7.4	0.5	
Delay (s)	25.0	22.6			24.5		32.6	5.8		36.5	9.2	
Level of Service	C	C			C		C	A		D	A	
Approach Delay (s)		24.2			24.5			10.1			9.5	
Approach LOS		C			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	11.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	59.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	58.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	58	66	1006	83	65	570
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0		4.0	4.0
Lane Util. Factor	1.00		0.95		1.00	0.95
Frt	0.93		0.99		1.00	1.00
Flt Protected	0.98		1.00		0.95	1.00
Satd. Flow (prot)	1706		3499		1770	3539
Flt Permitted	0.98		1.00		0.95	1.00
Satd. Flow (perm)	1706		3499		1770	3539
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	64	73	1118	92	72	633
RTOR Reduction (vph)	64	0	6	0	0	0
Lane Group Flow (vph)	73	0	1204	0	72	633
Heavy Vehicles (%)	1%	1%	2%	2%	2%	2%
Turn Type	NA		NA		Prot	NA
Protected Phases	8		2		1	6
Permitted Phases						
Actuated Green, G (s)	6.6		30.4		3.2	37.6
Effective Green, g (s)	6.6		30.4		3.2	37.6
Actuated g/C Ratio	0.13		0.58		0.06	0.72
Clearance Time (s)	4.0		4.0		4.0	4.0
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	215		2037		108	2549
v/s Ratio Prot	c0.04		c0.34		c0.04	0.18
v/s Ratio Perm						
v/c Ratio	0.34		0.59		0.67	0.25
Uniform Delay, d1	20.8		6.9		24.0	2.5
Progression Factor	1.00		1.00		1.00	1.00
Incremental Delay, d2	0.9		1.3		14.5	0.2
Delay (s)	21.8		8.2		38.4	2.7
Level of Service	C		A		D	A
Approach Delay (s)	21.8		8.2			6.4
Approach LOS	C		A			A

Intersection Summary			
HCM 2000 Control Delay	8.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	52.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	51.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	34	62	50	172	116	50	81	659	298	33	371	31
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	0.95	
Frt	1.00	0.93		1.00	0.95		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1787	1755		1787	1797		1770	1863	1583	1770	3498	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1787	1755		1787	1797		1770	1863	1583	1770	3498	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	37	67	54	187	126	54	88	716	324	36	403	34
RTOR Reduction (vph)	0	44	0	0	22	0	0	0	150	0	5	0
Lane Group Flow (vph)	37	77	0	187	158	0	88	716	174	36	432	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA		Prot	NA		Prot	NA	Perm	Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			
Actuated Green, G (s)	2.1	9.1		7.2	14.2		6.7	33.5	33.5	1.4	28.2	
Effective Green, g (s)	2.1	9.1		7.2	14.2		6.7	33.5	33.5	1.4	28.2	
Actuated g/C Ratio	0.03	0.14		0.11	0.21		0.10	0.50	0.50	0.02	0.42	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	55	237		191	379		176	928	789	36	1467	
v/s Ratio Prot	0.02	0.04		c0.10	c0.09		c0.05	c0.38		0.02	0.12	
v/s Ratio Perm									0.11			
v/c Ratio	0.67	0.32		0.98	0.42		0.50	0.77	0.22	1.00	0.29	
Uniform Delay, d1	32.2	26.3		29.9	22.9		28.7	13.7	9.5	32.9	12.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	27.8	0.8		58.3	0.7		2.2	6.2	0.6	150.0	0.5	
Delay (s)	60.0	27.1		88.3	23.7		30.9	19.9	10.1	182.9	13.4	
Level of Service	E	C		F	C		C	B	B	F	B	
Approach Delay (s)		34.8			56.6			18.0			26.3	
Approach LOS		C			E			B			C	

Intersection Summary			
HCM 2000 Control Delay	27.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	67.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	22	3	4	73	4	122	1	472	12	52	1266	33
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.95	0.95			1.00	1.00	1.00	0.95	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00			1.00	0.99	1.00	1.00	0.97	1.00	1.00	
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.95			1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	0.98			0.95	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1715	1678			1779	1562	1805	3406	1485	1770	3526	
Flt Permitted	0.95	0.98			0.95	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1715	1678			1779	1562	1805	3406	1485	1770	3526	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	25	3	5	83	5	139	1	536	14	59	1439	38
RTOR Reduction (vph)	0	5	0	0	0	123	0	0	6	0	1	0
Lane Group Flow (vph)	17	11	0	0	88	16	1	536	8	59	1476	0
Confl. Peds. (#/hr)						2			3			
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	0%	6%	6%	2%	2%	2%
Turn Type	Split	NA		Split	NA	Perm	Prot	NA	Perm	Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						8			2			
Actuated Green, G (s)	3.9	3.9			9.4	9.4	0.7	48.0	48.0	6.3	53.6	
Effective Green, g (s)	3.9	3.9			9.4	9.4	0.7	48.0	48.0	6.3	53.6	
Actuated g/C Ratio	0.05	0.05			0.11	0.11	0.01	0.57	0.57	0.08	0.64	
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	80	78			200	175	15	1955	852	133	2260	
v/s Ratio Prot	c0.01	0.01			c0.05		0.00	c0.16		0.03	c0.42	
v/s Ratio Perm						0.01			0.01			
v/c Ratio	0.21	0.14			0.44	0.09	0.07	0.27	0.01	0.44	0.65	
Uniform Delay, d1	38.4	38.2			34.6	33.3	41.1	9.0	7.6	37.0	9.3	
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.3	0.9			1.5	0.2	1.9	0.3	0.0	2.4	1.5	
Delay (s)	39.7	39.1			36.2	33.5	43.0	9.3	7.6	39.3	10.7	
Level of Service	D	D			D	C	D	A	A	D	B	
Approach Delay (s)		39.4			34.5			9.4			11.8	
Approach LOS		D			C			A			B	

Intersection Summary			
HCM 2000 Control Delay	13.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	83.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	61.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	1	55	0	25	0	545	84	36	1346	2
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	0	1	61	0	28	0	606	93	40	1496	2
Pedestrians		1			1						2	
Lane Width (ft)		12.0			12.0						12.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						0	
Right turn flare (veh)												
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (ft)											902	
pX, platoon unblocked												
vC, conflicting volume	1910	2278	750	1482	2232	352	1499			700		
vC1, stage 1 conf vol	1578	1578		653	653							
vC2, stage 2 conf vol	333	700		829	1579							
vCu, unblocked vol	1910	2278	750	1482	2232	352	1499			700		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	77	100	96	100			96		
cM capacity (veh/h)	108	150	358	262	152	648	443			899		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	1	89	303	396	40	997	501
Volume Left	0	61	0	0	40	0	0
Volume Right	1	28	0	93	0	0	2
cSH	358	322	443	1700	899	1700	1700
Volume to Capacity	0.00	0.28	0.00	0.23	0.04	0.59	0.29
Queue Length 95th (ft)	0	28	0	0	3	0	0
Control Delay (s)	15.1	20.4	0.0	0.0	9.2	0.0	0.0
Lane LOS	C	C			A		
Approach Delay (s)	15.1	20.4	0.0		0.2		
Approach LOS	C	C					

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	55.3%	ICU Level of Service	B
Analysis Period (min)	15		

TRAFFIC WORKS LLC

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	393	45	420	149	121	994
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.97		1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00		1.00	0.99	1.00	1.00
Flpb, ped/bikes	1.00		1.00	1.00	1.00	1.00
Frt	0.98		1.00	0.85	1.00	1.00
Flt Protected	0.96		1.00	1.00	0.95	1.00
Satd. Flow (prot)	3364		1827	1533	1787	1881
Flt Permitted	0.96		1.00	1.00	0.95	1.00
Satd. Flow (perm)	3364		1827	1533	1787	1881
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	437	50	467	166	134	1104
RTOR Reduction (vph)	11	0	0	0	0	0
Lane Group Flow (vph)	476	0	467	166	134	1104
Confl. Peds. (#/hr)	3	1		3		
Heavy Vehicles (%)	3%	3%	4%	4%	1%	1%
Turn Type	NA		NA	Free	Prot	NA
Protected Phases	8		2		1	6
Permitted Phases				Free		
Actuated Green, G (s)	17.9		47.1	90.0	13.0	64.1
Effective Green, g (s)	17.9		47.1	90.0	13.0	64.1
Actuated g/C Ratio	0.20		0.52	1.00	0.14	0.71
Clearance Time (s)	4.0		4.0		4.0	4.0
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	669		956	1533	258	1339
v/s Ratio Prot	c0.14		0.26		0.07	c0.59
v/s Ratio Perm				0.11		
v/c Ratio	0.71		0.49	0.11	0.52	0.82
Uniform Delay, d1	33.6		13.7	0.0	35.6	9.0
Progression Factor	1.00		1.00	1.00	0.79	0.35
Incremental Delay, d2	3.6		1.8	0.1	1.3	4.4
Delay (s)	37.2		15.5	0.1	29.3	7.5
Level of Service	D		B	A	C	A
Approach Delay (s)	37.2		11.5			9.9
Approach LOS	D		B			A

Intersection Summary			
HCM 2000 Control Delay	16.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	29	42	164	7	147	13	398	111	184	859	186
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes		0.99			0.99		1.00	1.00	0.98	1.00	1.00	1.00
Flpb, ped/bikes		1.00			1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.93			0.94		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99			0.97		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1737			1692		1770	1863	1548	1770	1863	1583
Flt Permitted		0.96			0.80		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1672			1394		1770	1863	1548	1770	1863	1583
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	11	31	45	174	7	156	14	423	118	196	914	198
RTOR Reduction (vph)	0	33	0	0	39	0	0	0	65	0	0	80
Lane Group Flow (vph)	0	54	0	0	298	0	14	423	53	196	914	118
Confl. Peds. (#/hr)			1			1			1			
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Perm	NA		Perm	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8					2			6
Actuated Green, G (s)		23.6			23.6		0.8	40.7	40.7	13.7	53.6	53.6
Effective Green, g (s)		23.6			23.6		0.8	40.7	40.7	13.7	53.6	53.6
Actuated g/C Ratio		0.26			0.26		0.01	0.45	0.45	0.15	0.60	0.60
Clearance Time (s)		4.0			4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		438			365		15	842	700	269	1109	942
v/s Ratio Prot							0.01	c0.23		0.11	c0.49	
v/s Ratio Perm		0.03			c0.21				0.03			0.07
v/c Ratio		0.12			0.82		0.93	0.50	0.08	0.73	0.82	0.13
Uniform Delay, d1		25.3			31.2		44.6	17.5	14.0	36.4	14.5	8.0
Progression Factor		1.00			1.00		0.69	0.42	0.13	0.85	0.77	0.38
Incremental Delay, d2		0.1			13.1		186.9	1.9	0.2	9.0	6.6	0.3
Delay (s)		25.4			44.3		217.6	9.3	2.1	39.8	17.8	3.3
Level of Service		C			D		F	A	A	D	B	A
Approach Delay (s)		25.4			44.3			13.0			18.9	
Approach LOS		C			D			B			B	

Intersection Summary			
HCM 2000 Control Delay	21.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	83.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	1	223	8	3	0	66	529	12	34	948	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.85			1.00		1.00	1.00		1.00	1.00	
Flt Protected	0.95	1.00			0.96		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1787	1600			1813		1770	3526		1770	3539	
Flt Permitted	0.75	1.00			0.49		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1410	1600			929		1770	3526		1770	3539	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	75	1	240	9	3	0	71	569	13	37	1019	1
RTOR Reduction (vph)	0	172	0	0	0	0	0	1	0	0	0	0
Lane Group Flow (vph)	75	69	0	0	12	0	71	581	0	37	1020	0
Confl. Peds. (#/hr)									1			
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Turn Type	Perm	NA		Perm	NA		Prot	NA		Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)	10.8	10.8			10.8		5.6	63.6		3.6	61.6	
Effective Green, g (s)	10.8	10.8			10.8		5.6	63.6		3.6	61.6	
Actuated g/C Ratio	0.12	0.12			0.12		0.06	0.71		0.04	0.68	
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	169	192			111		110	2491		70	2422	
v/s Ratio Prot		0.04					c0.04	0.16		0.02	c0.29	
v/s Ratio Perm	c0.05				0.01							
v/c Ratio	0.44	0.36			0.11		0.65	0.23		0.53	0.42	
Uniform Delay, d1	36.8	36.4			35.3		41.2	4.6		42.4	6.3	
Progression Factor	1.00	1.00			1.00		1.11	0.37		1.00	1.00	
Incremental Delay, d2	1.9	1.1			0.4		11.0	0.2		7.0	0.5	
Delay (s)	38.7	37.5			35.7		56.7	1.9		49.4	6.8	
Level of Service	D	D			D		E	A		D	A	
Approach Delay (s)		37.8			35.7			7.9			8.3	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM 2000 Control Delay	12.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	53.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	63	55	481	68	145	904
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0		4.0	4.0
Lane Util. Factor	1.00		0.95		1.00	0.95
Frt	0.94		0.98		1.00	1.00
Flt Protected	0.97		1.00		0.95	1.00
Satd. Flow (prot)	1718		3474		1770	3539
Flt Permitted	0.97		1.00		0.95	1.00
Satd. Flow (perm)	1718		3474		1770	3539
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	72	62	547	77	165	1027
RTOR Reduction (vph)	54	0	11	0	0	0
Lane Group Flow (vph)	80	0	613	0	165	1027
Heavy Vehicles (%)	1%	1%	2%	2%	2%	2%
Turn Type	NA		NA		Prot	NA
Protected Phases	8		2		1	6
Permitted Phases						
Actuated Green, G (s)	6.7		26.9		6.0	36.9
Effective Green, g (s)	6.7		26.9		6.0	36.9
Actuated g/C Ratio	0.13		0.52		0.12	0.72
Clearance Time (s)	4.0		4.0		4.0	4.0
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	223		1811		205	2530
v/s Ratio Prot	c0.05		0.18		c0.09	c0.29
v/s Ratio Perm						
v/c Ratio	0.36		0.34		0.80	0.41
Uniform Delay, d1	20.5		7.2		22.2	3.0
Progression Factor	1.00		1.00		1.00	1.00
Incremental Delay, d2	1.0		0.5		20.1	0.5
Delay (s)	21.5		7.7		42.3	3.4
Level of Service	C		A		D	A
Approach Delay (s)	21.5		7.7			8.8
Approach LOS	C		A			A

Intersection Summary			
HCM 2000 Control Delay	9.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	51.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	40.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	18	65	73	221	69	33	24	299	159	23	707	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	0.95	
Frt	1.00	0.92		1.00	0.95		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1787	1732		1787	1791		1770	1863	1583	1770	3521	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1787	1732		1787	1791		1770	1863	1583	1770	3521	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	19	70	78	238	74	35	26	322	171	25	760	27
RTOR Reduction (vph)	0	66	0	0	25	0	0	0	96	0	2	0
Lane Group Flow (vph)	19	82	0	238	84	0	26	322	75	25	785	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA		Prot	NA		Prot	NA	Perm	Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			
Actuated Green, G (s)	0.7	9.0		8.2	16.5		2.1	26.6	26.6	0.7	25.2	
Effective Green, g (s)	0.7	9.0		8.2	16.5		2.1	26.6	26.6	0.7	25.2	
Actuated g/C Ratio	0.01	0.15		0.14	0.27		0.03	0.44	0.44	0.01	0.42	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	20	257		242	488		61	819	695	20	1466	
v/s Ratio Prot	0.01	c0.05		c0.13	0.05		c0.01	0.17		0.01	c0.22	
v/s Ratio Perm									0.05			
v/c Ratio	0.95	0.32		0.98	0.17		0.43	0.39	0.11	1.25	0.54	
Uniform Delay, d1	29.9	23.0		26.1	16.8		28.6	11.5	10.0	29.9	13.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	175.6	0.7		52.9	0.2		4.7	1.4	0.3	288.2	1.4	
Delay (s)	205.5	23.7		78.9	17.0		33.3	12.9	10.3	318.1	14.7	
Level of Service	F	C		E	B		C	B	B	F	B	
Approach Delay (s)		44.4			59.5			13.1			24.0	
Approach LOS		D			E			B			C	

Intersection Summary			
HCM 2000 Control Delay	29.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	60.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	50.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	101	7	7	89	1	31	9	1333	59	39	621	101
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.95	0.95			1.00	1.00	1.00	0.95	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00			1.00	0.99	1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.98			1.00	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	0.96			0.95	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1715	1708			1793	1579	1787	3574	1564	1770	3465	
Flt Permitted	0.95	0.96			0.95	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1715	1708			1793	1579	1787	3574	1564	1770	3465	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	106	7	7	94	1	33	9	1403	62	41	654	106
RTOR Reduction (vph)	0	5	0	0	0	30	0	0	28	0	7	0
Lane Group Flow (vph)	60	55	0	0	95	3	9	1403	34	41	753	0
Confl. Peds. (#/hr)						1			1			
Heavy Vehicles (%)	0%	0%	0%	1%	1%	1%	1%	1%	1%	2%	2%	2%
Turn Type	Split	NA		Split	NA	Perm	Prot	NA	Perm	Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						8			2			
Actuated Green, G (s)	6.6	6.6			7.7	7.7	0.7	41.4	41.4	3.7	44.4	
Effective Green, g (s)	6.6	6.6			7.7	7.7	0.7	41.4	41.4	3.7	44.4	
Actuated g/C Ratio	0.09	0.09			0.10	0.10	0.01	0.55	0.55	0.05	0.59	
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	150	149			183	161	16	1962	858	86	2040	
v/s Ratio Prot	c0.03	0.03			c0.05		0.01	c0.39		c0.02	0.22	
v/s Ratio Perm						0.00			0.02			
v/c Ratio	0.40	0.37			0.52	0.02	0.56	0.72	0.04	0.48	0.37	
Uniform Delay, d1	32.5	32.4			32.1	30.5	37.2	12.6	7.8	34.9	8.1	
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.7	1.6			2.5	0.1	38.3	2.3	0.1	4.1	0.5	
Delay (s)	34.3	34.0			34.6	30.5	75.5	14.9	7.9	39.0	8.7	
Level of Service	C	C			C	C	E	B	A	D	A	
Approach Delay (s)		34.1			33.5			15.0			10.2	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM 2000 Control Delay	15.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	75.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	55.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	1	19	0	20	1	1347	182	34	801	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	1	21	0	22	1	1464	198	37	871	0
Pedestrians					1						2	
Lane Width (ft)					12.0						12.0	
Walking Speed (ft/s)					4.0						4.0	
Percent Blockage					0						0	
Right turn flare (veh)												
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (ft)											902	
pX, platoon unblocked												
vC, conflicting volume	1703	2610	435	2077	2511	834	871			1663		
vC1, stage 1 conf vol	945	945		1566	1566							
vC2, stage 2 conf vol	758	1665		510	945							
vCu, unblocked vol	1703	2610	435	2077	2511	834	871			1663		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	82	100	93	100			90		
cM capacity (veh/h)	199	108	574	113	147	315	776			387		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	1	42	733	930	37	580	290
Volume Left	0	21	1	0	37	0	0
Volume Right	1	22	0	198	0	0	0
cSH	574	168	776	1700	387	1700	1700
Volume to Capacity	0.00	0.25	0.00	0.55	0.10	0.34	0.17
Queue Length 95th (ft)	0	24	0	0	8	0	0
Control Delay (s)	11.3	33.6	0.0	0.0	15.3	0.0	0.0
Lane LOS	B	D	A		C		
Approach Delay (s)	11.3	33.6	0.0		0.6		
Approach LOS	B	D					

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	59.6%	ICU Level of Service	B
Analysis Period (min)	15		

TRAFFIC WORKS LLC

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	305	81	1091	295	111	532
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.97		1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00		1.00	0.99	1.00	1.00
Flpb, ped/bikes	1.00		1.00	1.00	1.00	1.00
Frt	0.97		1.00	0.85	1.00	1.00
Flt Protected	0.96		1.00	1.00	0.95	1.00
Satd. Flow (prot)	3351		1881	1578	1787	1881
Flt Permitted	0.96		1.00	1.00	0.95	1.00
Satd. Flow (perm)	3351		1881	1578	1787	1881
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	328	87	1173	317	119	572
RTOR Reduction (vph)	27	0	0	0	0	0
Lane Group Flow (vph)	388	0	1173	317	119	572
Confl. Peds. (#/hr)	2	1		3		
Heavy Vehicles (%)	2%	2%	1%	1%	1%	1%
Turn Type	NA		NA	Free	Prot	NA
Protected Phases	8		2		1	6
Permitted Phases				Free		
Actuated Green, G (s)	17.4		68.6	105.0	7.0	79.6
Effective Green, g (s)	17.4		68.6	105.0	7.0	79.6
Actuated g/C Ratio	0.17		0.65	1.00	0.07	0.76
Clearance Time (s)	4.0		4.0		4.0	4.0
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	555		1228	1578	119	1425
v/s Ratio Prot	c0.12		c0.62		c0.07	0.30
v/s Ratio Perm				0.20		
v/c Ratio	0.70		0.96	0.20	1.00	0.40
Uniform Delay, d1	41.3		16.8	0.0	49.0	4.4
Progression Factor	1.00		1.00	1.00	0.82	0.61
Incremental Delay, d2	3.8		17.0	0.3	75.7	0.7
Delay (s)	45.2		33.8	0.3	115.8	3.4
Level of Service	D		C	A	F	A
Approach Delay (s)	45.2		26.6			22.8
Approach LOS	D		C			C

Intersection Summary			
HCM 2000 Control Delay	28.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	9	20	14	139	20	178	29	905	252	109	508	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes		0.99			0.99		1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes		1.00			1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.95			0.93		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99			0.98		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1783			1717		1805	1900	1579	1787	1881	1563
Flt Permitted		0.93			0.86		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1667			1501		1805	1900	1579	1787	1881	1563
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	10	22	16	156	22	200	33	1017	283	122	571	11
RTOR Reduction (vph)	0	12	0	0	41	0	0	0	82	0	0	5
Lane Group Flow (vph)	0	36	0	0	337	0	33	1017	201	122	571	6
Confl. Peds. (#/hr)			1			1			1			1
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	1%
Turn Type	Perm	NA		Perm	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8					2			6
Actuated Green, G (s)		27.1			27.1		3.9	57.3	57.3	8.6	62.0	62.0
Effective Green, g (s)		27.1			27.1		3.9	57.3	57.3	8.6	62.0	62.0
Actuated g/C Ratio		0.26			0.26		0.04	0.55	0.55	0.08	0.59	0.59
Clearance Time (s)		4.0			4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		430			387		67	1036	861	146	1110	922
v/s Ratio Prot							0.02	c0.54		c0.07	0.30	
v/s Ratio Perm		0.02			c0.22				0.13			0.00
v/c Ratio		0.08			0.87		0.49	0.98	0.23	0.84	0.51	0.01
Uniform Delay, d1		29.5			37.3		49.6	23.3	12.4	47.5	12.6	8.8
Progression Factor		1.00			1.00		1.20	0.44	0.07	0.81	0.68	1.00
Incremental Delay, d2		0.1			18.8		2.6	15.2	0.3	31.4	1.7	0.0
Delay (s)		29.6			56.1		62.2	25.5	1.2	70.0	10.3	8.9
Level of Service		C			E		E	C	A	E	B	A
Approach Delay (s)		29.6			56.1			21.3			20.6	
Approach LOS		C			E			C			C	

Intersection Summary			
HCM 2000 Control Delay	26.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	90.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	59	23	8	57	5	87	181	927	32	7	512	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96			0.92		1.00	0.99		1.00	0.98	
Flt Protected	0.95	1.00			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1787	1803			1717		1787	3556		1787	3507	
Flt Permitted	0.45	1.00			0.86		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	843	1803			1506		1787	3556		1787	3507	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	62	24	8	60	5	92	191	976	34	7	539	65
RTOR Reduction (vph)	0	7	0	0	72	0	0	1	0	0	5	0
Lane Group Flow (vph)	62	25	0	0	85	0	191	1009	0	7	599	0
Confl. Peds. (#/hr)			4									3
Heavy Vehicles (%)	1%	1%	1%	0%	0%	0%	1%	1%	1%	1%	1%	1%
Turn Type	Perm	NA		Perm	NA		Prot	NA		Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)	11.3	11.3			11.3		24.2	80.3		1.4	57.5	
Effective Green, g (s)	11.3	11.3			11.3		24.2	80.3		1.4	57.5	
Actuated g/C Ratio	0.11	0.11			0.11		0.23	0.76		0.01	0.55	
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	90	194			162		411	2719		23	1920	
v/s Ratio Prot		0.01					c0.11	c0.28		0.00	c0.17	
v/s Ratio Perm	c0.07				0.06							
v/c Ratio	0.69	0.13			0.52		0.46	0.37		0.30	0.31	
Uniform Delay, d1	45.2	42.4			44.3		34.8	4.1		51.3	13.0	
Progression Factor	1.00	1.00			1.00		0.61	0.14		1.00	1.00	
Incremental Delay, d2	19.7	0.3			3.0		0.3	0.1		7.4	0.4	
Delay (s)	64.9	42.7			47.3		21.7	0.7		58.7	13.4	
Level of Service	E	D			D		C	A		E	B	
Approach Delay (s)		57.3			47.3			4.1			13.9	
Approach LOS		E			D			A			B	

Intersection Summary			
HCM 2000 Control Delay	12.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	58.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	58	66	1006	83	65	570
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0		4.0	4.0
Lane Util. Factor	1.00		0.95		1.00	0.95
Frt	0.93		0.99		1.00	1.00
Flt Protected	0.98		1.00		0.95	1.00
Satd. Flow (prot)	1706		3499		1770	3539
Flt Permitted	0.98		1.00		0.95	1.00
Satd. Flow (perm)	1706		3499		1770	3539
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	64	73	1118	92	72	633
RTOR Reduction (vph)	64	0	6	0	0	0
Lane Group Flow (vph)	73	0	1204	0	72	633
Heavy Vehicles (%)	1%	1%	2%	2%	2%	2%
Turn Type	NA		NA		Prot	NA
Protected Phases	8		2		1	6
Permitted Phases						
Actuated Green, G (s)	6.6		30.4		3.2	37.6
Effective Green, g (s)	6.6		30.4		3.2	37.6
Actuated g/C Ratio	0.13		0.58		0.06	0.72
Clearance Time (s)	4.0		4.0		4.0	4.0
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	215		2037		108	2549
v/s Ratio Prot	c0.04		c0.34		c0.04	0.18
v/s Ratio Perm						
v/c Ratio	0.34		0.59		0.67	0.25
Uniform Delay, d1	20.8		6.9		24.0	2.5
Progression Factor	1.00		1.00		1.00	1.00
Incremental Delay, d2	0.9		1.3		14.5	0.2
Delay (s)	21.8		8.2		38.4	2.7
Level of Service	C		A		D	A
Approach Delay (s)	21.8		8.2			6.4
Approach LOS	C		A			A

Intersection Summary			
HCM 2000 Control Delay	8.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	52.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	51.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	34	62	50	172	116	50	81	659	298	33	371	31
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	0.95	
Frt	1.00	0.93		1.00	0.95		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1787	1755		1787	1797		1770	1863	1583	1770	3498	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1787	1755		1787	1797		1770	1863	1583	1770	3498	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	37	67	54	187	126	54	88	716	324	36	403	34
RTOR Reduction (vph)	0	41	0	0	20	0	0	0	147	0	5	0
Lane Group Flow (vph)	37	80	0	187	160	0	88	716	177	36	432	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Turn Type	Prot	NA		Prot	NA		Prot	NA	Perm	Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			
Actuated Green, G (s)	2.2	8.7		9.2	15.7		7.8	34.8	34.8	2.2	29.2	
Effective Green, g (s)	2.2	8.7		9.2	15.7		7.8	34.8	34.8	2.2	29.2	
Actuated g/C Ratio	0.03	0.12		0.13	0.22		0.11	0.49	0.49	0.03	0.41	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	55	215		231	397		194	914	776	54	1440	
v/s Ratio Prot	0.02	0.05		c0.10	c0.09		c0.05	c0.38		0.02	0.12	
v/s Ratio Perm									0.11			
v/c Ratio	0.67	0.37		0.81	0.40		0.45	0.78	0.23	0.67	0.30	
Uniform Delay, d1	34.0	28.6		30.0	23.6		29.6	14.9	10.3	34.0	14.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	27.8	1.1		18.5	0.7		1.7	6.7	0.7	26.9	0.5	
Delay (s)	61.8	29.7		48.5	24.3		31.2	21.6	11.0	60.9	14.5	
Level of Service	E	C		D	C		C	C	B	E	B	
Approach Delay (s)		37.2			36.6			19.3			18.1	
Approach LOS		D			D			B			B	

Intersection Summary			
HCM 2000 Control Delay	23.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	70.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group